SHORT COMMUNICATION

Evaluation of Exotic Rapeseed-Mustard Genetic Resources for Quality Characteristics

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Because of known adverse effects of high erucic acid in oil (Ackman *et al.*, 1977) and glucosinolate content in seed-meal (Bille *et al.*, 1983) in rapeseed-mustard, reducing erucic acid up to 2 per cent (low) and glucosinolate content up to 30 μ moles/defatted seed-meal (low) and combining both the traits to develop double low varieties has been the focus of Indian breeding programme in recent years. The Indian cultivars are rich in erucic acid (30.9-56.7 per cent), low in oleic acid (6.7-22.6 per cent) and high in glucosinolates (41.0-108.9 μ moles), thus variability for desirable level of these traits is lacking in indigenous rapeseed-mustard genetic resources. Nevertheless, a few lines with low erucic acid and or low glucosinolate content have been registered with National Gene Bank at National Bureau of Plant Genetic Resources, New Delhi (Anonymous, 2004). In Australia, Europe and America, the double low varieties are largely grown though predominantly of rapeseed. Recently, a double low mustard variety has been released in Canada and many promising lines are available in Australia. Such exotic germplasm lines would serve as an important reservoir of useful gene(s) besides quality parameter. It is also expected that utilization of this gene pool would lead to broadening of the genetic base of Indian cultivars because of divergent nature due to diverse selection pressure in varied ecological conditions. Hence, there is need for evaluating the available exotic genetic resources to search for new sources for low and double low characteristics, agronomic characters for utilization in breeding programme to diversify the genetic base of indigenous available, lines/varieties.

The materials for the present investigation comprised one hundred thirty two exotic accessions of rapeseed-mustard grown in 3-row plots of 5-meter length during 2003-04 crop season in augmented design. The plant spacing was 30 x 10-15 cm. A fertilizer dose of 40:20 kg/ha of N and P_2O_5 was applied just before sowing and another dose of 40 kg/ha of N was top dressed after first irrigation. The plant protection measures were taken as and when required. Plant height was measured on 5 plants while days to maturity were computed on line basis. The open- and self-pollinated seeds of each accession were harvested. A composite sample of open-pollinated seeds was used to estimate oil and protein content by NIR (Kumar *et al.*, 2003). The self-seeds were used for fatty acid analysis by gas liquid chromatograph (Nucon Model 5765) using SP 2300 + 2310 SS columns. The detailed method for fatty acid analysis has been described elsewhere (Chauhan *et al.* 2002). ELISA Reader at 405 nm analyzed the glucosinolate content of the open-pollinated seeds from single plant following tetrachloropalladate method (Kumar *et al.* 2004). To assess variation, the range, mean and coefficients of variability (CV) for each character were computed using standard statistical methods.

The variability for various agronomic, oil and seed meal quality characteristics is presented in Table 1. The variability was maximum for glucosinolate content and minimum for oil content. The variability was low for days to maturity and protein content. Among the fatty acids, eicosenoic acid followed by erucic acid showed substantial variation (Table1).

Plant height and days to maturity showed moderate variation (Table1). The plant height ranged from 105 cm (EC511436) to 247 cm (EC511399). The genotypes showing short plant height were EC511436 (105 cm), EC511713 (116.0 cm), EC511663 (125 cm), EC511599 (130cm) and EC511589 (130.8 cm). The days to maturing varied from 131 days (EC511724) to 163 days (EC511794). The early maturity genotypes were EC511724 (131 days), EC511434 (133 days), EC511435 (134 days), EC511433 (135 days) and EC511-615 (135 days).

Palmitic and Stearic Acid

These are the saturated fatty acids and being hypercholesteremic (Mathur and Sharma, 1993), thus their excessive intake increases cholesterol level in blood

Table 1. Mean, range and coefficient of variability (CV) for various quality parameters and agronomic characters in exotic rapeseed-mustard germplasm

Character	Range	Mean ± SEm	CV (%)
Plant height (cm)	105.0–247.0	184.6 ±2.2	13.8
Maturity (days)	131–163	147.0 ±1.2	8.9
1000–seed weight (g)	1.2–4.6	2.0 ± 0.05	27.6
Oil content (%)	35.2–42.6	40.1 ±0.12	3.3
Protein content (%)	19.1–26.7	22.9 ±0.18	9.4
Palmitic + stearic acid (%)	1.3–5.0	3.5 ±0.05	16.2
Oleic acid (%)	11.0–40.8	32.3 ±0.72	25.6
Linoleic acid (%)	19.3–46.9	39.1 ±0.59	17.5
Linolenic acid (%)	7.0–36.3	18.6 ±0.33	20.7
Eicosenoic acid (%)	5.2–16.1	10.8 ±0.29	31.4
Erucic acid (%)	0–46.4	33.3 ±0.82	28.5
Glucosinolate content*	17.1–99.6	30.7 ±1.75	64.8

*μ moles / g defatted seed meal

consequently risk of coronary heart diseases. Preferred edible oil should have only upto 7 per cent saturated fatty acids. In this context, rapeseed-mustard oil is quite desirable since it contains low amount of saturated fatty acids. In the present collection, palmitic and stearic acid ranged from 1.3 (EC 511713)-5.0 per cent (EC 511678).

Oleic acid is a mono-saturated fatty acid (C 18:1) and contributes to increased shelf life of the oil by reducing photo-oxidation. It also plays an important role in reducing the cholesterol level in the blood (Grundy, 1986), a major component associated with coronary heart diseases. The desirable level of oleic acid is about 60 per cent in double low cultivars. However, oleic acid in the present collection was low and ranged from 11.0-40.8 per cent, the highest being recorded in the accession EC511429. Ten accessions showed moderate oleic acid (> 38.1 per cent) and their characteristics are presented in Table 2. In earlier studies, oleic acid has been reported to vary between 6.7-22.7 per cent in indigenous germplasm (Anonymous, 2003).

Linoleic and Linolenic Acid

These are the two polyunsaturated fatty acids and not naturally synthesized in the body. Linoleic acid (C18:2) plays an important role in the synthesis of prostaglandins, which regulate various body functions (Mathur and Sharma, 1993). Linolenic acid (C 18:3), although only present in rapeseed-mustard oil and pretty desirable but it also imparts instability to the oil and thus reduces shelf life. Linoleic acid in the present exotic germplasm accessions ranged from 19.3 per cent (EC511434) to 46.9 per cent (EC511517) with a mean of 39.1± 0.59 and CV of 17.5 per cent whereas linolenic acid varied from 7.0 per cent (EC511724) to 36.3 per cent (EC511411).

Table 2. Characteristics of germplasm lines having relatively high oleic acid content (> 38.1%)

Character	EC511408	EC511538	EC511534	EC511665	EC511563	EC511566	EC511460	EC511429	EC511704	EC511419
Plant height (cm)	196.0	195.0	186.0	174.0	180.6	144.3	179.3	192.0	200.0	199.8
Maturity (days)	146	152	145	147	155	157	143	137	156	151
1000-seed - weight (g)	2.0	2.0	2.2	1.8	2.1	1.8	1.8	2.0	2.0	1.9
Oil content (%)	38.7	40.4	40.0	40.4	40.6	41.1	40.1	41.0	40.9	40.4
Protein content (%)	23.1	23.1	22.4	24.4	22.6	23.1	22.4	21.5	24.2	23.6
Palmitic + stearic acid (%)	3.7	3.9	4.2	4.0	4.2	4.1	3.9	3.7	3.7	3.8
Oleic acid (%)	40.0	38.7	38.1	39.3	39.5	40.0	40.5	40.8	40.4	40.0
Linoleic acid (%)	39.6	39.2	44.4	38.8	38.9	38.4	39.0	37.0	40.4	36.8
Linolenic acid (%)	11.4	18.1	13.2	17.8	17.2	17.4	16.6	18.4	15.3	19.3
Eicosenoic acid (%)	5.2	NIL	NIL	NIL	NIL	NIL	NIL	Nill	Nill	Nill
Erucic acid (%)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Glucosinolate content*	17.1	17.5	19.8	18.1	19.7	19.1	19.6	77.6	22.1	29.8

* μ moles/g defatted seed meal

Eicosenoic and Erucic Acid

These are long chain unsaturated fatty acids and considered anti-nutritional because of their adverse effects. Eicosenoic acid (C20: 1) showed wide variation in the present collection (Table 1) and EC 511408 had the lowest amount (5.2 per cent). Nevertheless, it varied from 5.2-16.1 per cent. In previous studies a range of 4.4-15.0 per cent was reported for this fatty acid (Anonymous, 2003). Erucic acid (C 22:1) ranged from 0.0-46.4 per cent and varied substantially in the present collection. 111 accessions had desirable level of erucic acid (< 2 per cent) only 5 accessions showed erucic acid in the range of 41.0-46.4 per cent. In earlier studies a wide variation of 30.9-56.7 per cent was reported in indigenous rapeseed-mustard varieties (Anonymous, 2003).

The present collection of exotic rapeseed-mustard accessions showed wide variation for glucosinolate content, CV 64.8 per cent. The overall mean was 30.7± 1.75 with a range of 17.1-99.6 μ moles/ g defatted seed meal. 51 accessions had very low glucosinolate (< 20 μ moles / g defatted seed meal) and further, 46 accessions also showed desirable level of < 30μ moles / g defatted seed meal. Of these, 51 accessions also had < 2 per cent erucic acid.

Oil and Protein Content

The varieties with high oil content get premium in the market. Development of high oil yielding genotypes is the major breeding objective in rapeseed-mustard. The present collection showed very low variability for oil content (CV 3.3 per cent). Nevertheless, 11 accessions had relatively high oil content (> 41.5 per cent). Further, eight of these accessions were also of double low types (Table 3). Rapeseed-mustard seed meal is a protein rich feed. The seed protein content in the present collection varied from 19.1-26.7 per cent but the variability is low for this character. The high protein content lines were EC511448 (26.7 per cent), EC511714 (25.9), EC511632 (25.4 per cent), EC511633 (25.1 per cent) and EC511493 (24.7 per cent).

The present collections prove to be a reservoir of important double low traits of oil and seed meal quality. Of the 132 accessions, 51 possess desirable level of both glucosinolate content and erucic acid which could be utilized in the quality breeding programme to diversify the base of Indian available low/ double low advanced breeding lines.

Table 3. Characteristics of germplasm lines having relatively high oil content (>41.5%)

Accession	Oleic acid (%)	Erucic acid (%)	Glucosino-late content*	Protein content (%)	Oil content (%)	1000-seed weight (g)	Plant height (cm)	Maturity (days)
EC511413	15.4	29.3	74.7	19.1	42.5	3.6	212.0	141
EC511419	40.0	< 2.0	29.8	21.5	41.9	2.0	204.0	150
EC511507	33.6	< 2.0	18.7	23.6	41.9	2.0	176.3	147
EC511415	37.4	< 2.0	26.1	22.7	42.0	2.0	203.0	143
EC511568	36.7	< 2.0	18.3	22.7	41.6	2.3	206.0	159
EC511411	21.4	8.5	39.2	21.1	42.3	2.0	215.0	140
EC511478	33.4	< 2.0	29.6	21.1	41.6	1.8	200.0	143
EC511690	34.8	< 2.0	19.1	22.3	41.5	2.0	125.0	148
EC511407	26.9	< 2.0	28.6	21.9	41.9	2.2	205.6	142
EC511490	31.5	< 2.0	19.0	23.1	41.5	2.0	198.5	147
EC511433	21.8	39.9	22.0	19.9	42.6	3.8	155.0	135

* μ moles / g defatted seed meal

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