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Evaluation of Selected Brassica Lines for Oil Quality Characteristics

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Abstract: Considerable variation among the lines were observed for total oil contents, oleic acid, linoleic acid, linolenic acid, erucic acid and glucosinolates. Maximum oil contents were recovered from WY and MG followed by a group of five lines with almost similar values (47%) and these could be a material of choice for transferring this potential into a desirable background. None of the lines exhibited desired level of erucic acid and glucosinolates. Present study successfully identified lines with improved oil content which could be advanced and utilized in future breeding programs for high oil content.

Key words: Brassica lines, oil quality, oil contents, oleic acid, linoleic acid, linolenic acid, erucic acid, glucosinolates

Introduction

Like many parts of the world, rape and mustard in Pakistan have been used as a major source of oil since long time. But use of Brassica oil in Pakistan has mainly been confined to anointing the body, for preserving pickles and as hair oil (Khan *et al*., 1987). The reason for not being the favorite for edible purposes is the presence of high percentage of erucic acid and linolenic acid contents in the oil, which not only deteriorate the oil quality but are also known to produce harmful effect on the body. Similarly, excessive quantity of sulfur containing compounds, glucosinolates in the oil-cake or meal are known to cause health problem in non-ruminant animals. However, as a result of intensive breeding efforts and through improvements in processing and refining techniques, Brassica oil and meal have gained widespread acceptability as an edible oil and as an animal meal (Vranceanu and Stoenescu, 1986; Anashchenko and Shpota, 1987; Krzymuski and Oleksiak, 1988; Meyer and Uppstrom, 1990; Varade, 1992).

In countries like Pakistan, traditional oil seed rape and mustard with high amount of undesirable toxic compounds are still under cultivation which need replacement with improved varieties with high yield and good quality characteristics. In present study, lines selected from inter and intra specific crosses were evaluated for their oil quality characteristics.

Materials and Methods

The source of material included F10 selected *Brassica* lines and their seven parents (Table 1) were planted at Peshawar in the last week of September 1992, using randomized complete block design with four replication. The plot size was 7.5 m consisting of 5 rows with 5 m length and spaced at 30 cm apart. Basal dozes of nitrogen and phosphorus fertilizers were applied at the sowing time. Irrigation and other cultural practices were performed as recommended. The insecticides Maiathion (20 ml/15 L) and Repcard (75 ml/12 L) were sprayed for the control of hairy caterpillar and cabbage butterfly, respectively. Early maturing lines/parents were harvested in early March, while late maturing in April 1993. Data on percent oil content for each line parent was determined by analysis done at NARC, Islamabad, with the help of Nuclear Magnetic Resonance (NMR), while percent erucic acid, percent oleic acid, percent linoleic acid and percent linolenic acid were accomplished through Gas Chromatography. The determi-nation of glucosinolates (micro mol/g) was done by using spectrophotometer.

Results and Discussion

Identification of lines with increased oil content was one of the main objectives of this study. Among the lines, maximum oil contents, 48.25 percent and 48.03 percent were recovered from WY and MG, respectively (Table 2). In former, the improvement may have been contributed by Wester while in later this could be the result of favorable gene combination and their expression for the trait. It was interesting to note most of the lines either surpassed both or one of the parents in percent oil content and contributions by parents belonging to *Brassica napus* were evitable. Similar results have been reported by Auld and Mahler (1986), Auld *et al*. (1987) and Villarreal-D *et al*. (1983).

Oleic acid is known to be a one of the main determiners of oil quality and its high contents are favored. It is obvious from Table 2 that inheritance of oleic acid was faithful and percent oleic acid recorded for the lines (except for LL-84) were more or less similar to the parents. Anticipated new gene combinations hence increase in the percent oleic acid was not achieved. Even LL-84, which had comparatively high oleic acid was not able to influence the trait in favor of improvement. Contrary to the present results, Stefanov and Gyurov (1986), Meyer and Uppstrom (1990) and Varade (1992) have reported improvement in oleic acid through breeding program.

The lines behaved differently in linoleic acid percentage. The MS and WL exhibited maximum linoleic acid values and both were higher as compared to their parents, however, former's value was closer to Marnoo, one of its contributing

Table 1: Number, parents and designation of the fifteen crosses

Cross. No	Parent I	Parent II	Cross designation
1.	Westar	Kiwi Salam	WS
2.	Altex	Yellow Raya	AY
3.	Ganyou-5	Kiwi Salam	GS
4.	Altex	Kiwi Salam	AS
5.	Westar	Yellow Raya	WY
6.	Marnoo	Westar	MW
7.	Westar	LL-84	WL
8.	Altex	P53-48-2	AP
9.	Marnoo	Ganyou-5	MG
10.	LL-84	Westar	LW
11.	Ganyou-5	Westar	GW
12.	Ganyou-5	Altex	GA
13.	Altex	Aphid resist. line	AAR
14.	LL-84	Kiwi Salem	LS
15.	Marnoo	Kiwi Salam	MS

Table 2: Average data on oil content, oleic acid and linoleic acid of fifteen Brassica lines and their seven parents

Genotypes	Oil content (%)	Oleic acid (%)	Linoleic acid (%)
AAR	47.28	0.85	19.58
WL	46.24	-	32.08
AP	45.98	0.94	22.88
LS	46.13	-	25.93
MG	48.03	1.11	25.24
WS	46.96	1.08	30.30
AY	47.21	-	29.50
LW	43.87	0.96	29.62
WY	48.24	0.97	21.11
GA	46.36	0.99	29.61
GS	45.58	-	29.75
MW	4797	1.69	25.55
AS	46.80	1.00	30.50
GW	47.51	1.10	29.37
MS	47.51	-	32.13
ALTEX	47.65	1.09	21.39
MARNOO	41.17	1.25	30.76
KIWI SALAM	47.60	-	26.05
GANYOU-5	41.39	0.82	16.69
WESTAR	47.09	-	28.84
P53-48-2	33.90	1.65	21.25
LL-84	36.42	4.28	25.10

parents (Table 2). The AAR and WY were found to be on the other extreme and again both the lines were much lower than their parents, which could be the result of transgressive segregation.

The highest percentage of linolenic acid among the lines was recorded for WL, which may be the result of codominance, as one of its parents, Westar was low while the other, LL-84 high in linolenic acid (Table 3). Other

Table 3: Average data on linolenic acid, erucic acid and glucasinolates of fifteen Brassica lines and their seven parents

Genotypes	Linolenic acid (%)	Erucic acid (%)	Glucosinolates (micro mole/g)
AAR	14.85	38.06	64.01
WL	18.28	22.26	64.01
AP	16.58	31.88	52.27
LS	15.60	29.30	87.50
MG	15.84	28.04	71.84
WS	16.81	23.82	71.84
AY	15.63	26.42	64.01
LW	16.70	25.67	87.50
WY	14.11	36.27	79.67
GA	16.89	25.34	64.01
GS	16.82	25.91	64.01
MW	15.71	30.68	64.01
AS	16.86	23.95	56.18
GW	16.75	29.07	60.10
MS	17.36	23.04	70.27
ALTEX	16.31	34.26	56.18
MARNO0	17.87	22.71	87.50
KIWI SALAM	16.94	28.22	60.10
GANYOU-5	14.21	42.39	79.67
WESTAR	17.16	25.77	60.10
P53-48-2	28.73	14.33	103.16
LL-84	25.59	12.02	79.67

lines, such as AP, LW and LS had P53-48-2 or LL-84 as one of their parents but linolenic acid contents recorded for these lines were comparable to their second parents, which were low in linolenic acid, so parents other than P53-48-2 or LL-84 may have influenced the trait. These findings are comparable to the results reported by Anashchenko and Shpota (1987) and Varade (1992), however, their data were on *Brassica compestris* and *Brassica juncea*, respectively.

Erucic acid is an unwanted fatty acid in the oil and its presence above 5 percent level is considered undesirable and if oil with more than 5 percent erucic acid is used for edible purposes, it may produce harmful effect on the body. The only line which had comparatively less but not to the required level of erucic acid was WL (Table 3), all other lines were found to be very high in erucic acid and non could be recommended on basis of this character.

Glucosinolates are determinant factor of seed cake quality and its desired level of concentration is less than 30 micro mole/g. Among the parents, Altex was found to be least in glucosinolates (56.18 micro mole/g) whereas, P53-48-2 was on the top (Table 3). The line AP had least glucosinolates value (52.27 micro mole /g) among the lines as well as the parents. It seems probable that Altex may have masked the affect of P53-48-2 in cross combination of AP. All other lines, where Altex was one of the parents, had moderate amount of glucosinolates, which is indicative of the fact that in cross combination Altex could mask the

influence of the other parent. Nevertheless, non of the lines had a desired level of glucosinolates. Mailer and Wratten (1985) also reported high percentage of glucosinolates in *Brassica juncea*.

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