Fatty Acid Variability in Indian Mustard (*Brassica juncea*) Lines Generated Through Inter – and/or Intra - specific hybridization

Nutan Kaushik and Abha Agnihotri*
Bioresources and Biotechnology Division
TERI, Habitat Place, Lodhi Road, New Delhi, India 110 003
Tel: 91-11-4682100/4682111, Fax: 91-11-4682144/4682145
Email: abhagni@teri.res.in

ABSTRACT
Indian mustard (*Brassica juncea*) occupies the largest acreage among all oleiferous brassicas grown in India. High oleic, moderate linoleic and low linolenic acid contents in the oil are considered beneficial for human consumption. For specialty oils, high concentrations of a particular single fatty acid are desirable for industrial purposes. Mustard oil has the lowest content of saturated fatty acids among the available edible oils, and also contains both essential fatty acids, linoleic and linolenic, which are required for important metabolic functions in the body. However, the oil obtained from presently cultivated varieties of Indian mustard is characterized by high amounts of erucic acid (40-50%) which is considered nutritionally undesirable and low oleic acid (10-15%) attributing to low shelf life. This paper reports the fatty acid variability in lines of *B. juncea* generated through inter – and/ or intra - specific hybridization for improving the fatty acid profile. Seeds were analyzed by gas liquid chromatography and lines having low erucic acid content (<2%) selected. The fatty acid profile of advanced generations of these lines revealed that oleic acid ranged from 38-49% as compared to 10-15% only in conventional varieties. Linoleic acid ranged from 30-42%, while linolenic acid ranged from 10-20%. The identified lines having low erucic acid/ high oleic acid/ high linoleic acid are being utilized in the quality improvement program for the development of *B. juncea* strains with desired fatty acid profiles for edible/ non-edible purposes.

Keywords: Fatty Acids-Brassica-Nutritional Quality-Oleic Acid

INTRODUCTION

Oils and fats are one of the important components of our diet. They provide the most concentrated source of energy and also help in absorption of certain vitamins viz. A,D,E and K. Fatty acid composition of an oil is extremely important as the presence or absence of different fatty acids and their relative amounts determine the nutritional quality of the oil. Presence of high amounts of saturated fats like palmitic is undesirable as they elevate blood cholesterol levels. Presence of polyunsaturated fatty acids (PUFA) viz. linoleic and linolenic acid is desirable as they prevent increase in serum cholestrol. However, high amounts of linolenic acid (>14%) decreases the shelf life of oil. Both linoleic and linolenic acids are essential fatty acids and need to be supplemented through diet, as our body cannot synthesize them. Oleic acid, a mono-unsaturated fatty acid (MUFA), has no ill effect on human body and also increases the shelf life of the oil. Therefore, oil having low saturated fats (<6%), high oleic acid (>50%), moderate amounts of linoleic (<40%) and low linolenic acid (<14%) are considered to be ideal for edible purposes (Potts et al, 1999).

In India, *Brassica juncea* is the most widely cultivated species of Brassica used for production of edible oil. However, the oil obtained from the currently grown varieties does not qualify the international standards due to presence of high amounts of erucic acid (40-55%) and low amounts of oleic acid (10-15%) (Kaushik and Agnihotri 2000). Although some progress has been made in recent past in terms of reduction of erucic acid up to the International Standards of <2% (Chauhan et al 2000), the fatty acid profile needs further improvement for edible/ industrial purposes. The

present paper discusses the progress made in the improvement of fatty acid profile through inter- and / or intra-specific hybridization in Indian mustard.

MATERIALS AND METHODS

The low erucic acid *B. juncea* strains Zem-1 and TERI (OE) M21 were used as pollen donors to transfer low erucic acid in the popularly grown Indian mustard var. Varuna and Pusa Bold. At the same time low erucic acid *B. napus* strains TERI (OE) R03 and R09 obtained through transgressive segregation (Agnihotri and Kaushik 1998) were used as pollen donors for transfer of high oleic acid content in *B. juncea* strains TERI (OE) M07 and M21. The plants were generated through sequential embryo rescue technique (Agnihotri 1993). The *B. juncea* type plants were selected and back crossed with low erucic acid *B. juncea* for restoration of plant type. The fatty acids profile of the plants, thus obtained through interspecific / intraspecific hybridization, was analysed by improved method of GLC (Kaushik and Agnihotri1997).

RESULTS

The variability of individual fatty acids recorded in the *B. juncea* lines is represented in Figure 1. As is evident from the figure a good number of samples recorded oleic acid in the range of 45-49%. This is a significant achievement as compared to previous reports where only one or two lines had 45-49%oleic acid. Majority of the samples registered linoleic acid in the range of 30-35%. A few samples recorded higher linoleic acid ranging from 40-42%. Nearly 50% samples recorded linolenic acid in the range of 10-15%. Linolenic acid of the remaining samples ranged from 15-20%. The fatty acid profile of some of the selected lines is given in Table 1.

Table 1. Fatty acid profile of selected *B. juncea* lines

	% Fatty Acid Composition				
Accession No	Palmitic (16:0)	Oleic (18:1)	Linoleic (18:2)	Linolenic (18:3)	Erucic acid (22:1)
HOM-14	4.62	48.16	31.94	15.14	<2%
HOM-12	4.46	48.24	32.66	14.29	<2%
HOM-19	4.30	48.83	31.71	15.15	<2%
HOM-15	4.62	48.79	32.88	13.50	<2%
HOM-16	4.58	48.85	33.34	13.01	<2%
HOM-20	4.81	49.78	31.48	13.59	<2%
HOM-51	4.98	48.00	34.38	12.63	<2%
HOM-52	5.52	48.00	39.36	11.32	<2%
HOM-53	4.74	48.53	35.69	10.96	<2%
HOM-54	4.18	48.55	29.03	17.79	<2%

DISCUSSION

In order to make the Indian mustard oil close to canola quality *B. juncea* oil, the oleic acid need to be raised to more than 50 per cent, linoleic <40% and linolenic <14% (Potts et al 1999). *Brassica juncea* lines having canola quality profiles have been developed in Canada, however, these lines being exotic in nature will not be suitable for Indian agro-climatic conditions. The oil of *B. juncea* lines developed through inter-and / or intra-specific crosses have high oleic acid upto 49% which is quite close to canola quality requirement as per FCC standards. Accessions HOM-20 recorded highest oleic acid (49.78%) whereas, accessions HOM-52 and HOM-53 synthesized low linolenic acid (10-11%). Lowest linoleic acid (29.03%)was recorded in accession HOM-54. Work is in progress for improvement of agronomic attributes and further enhancement of quality.

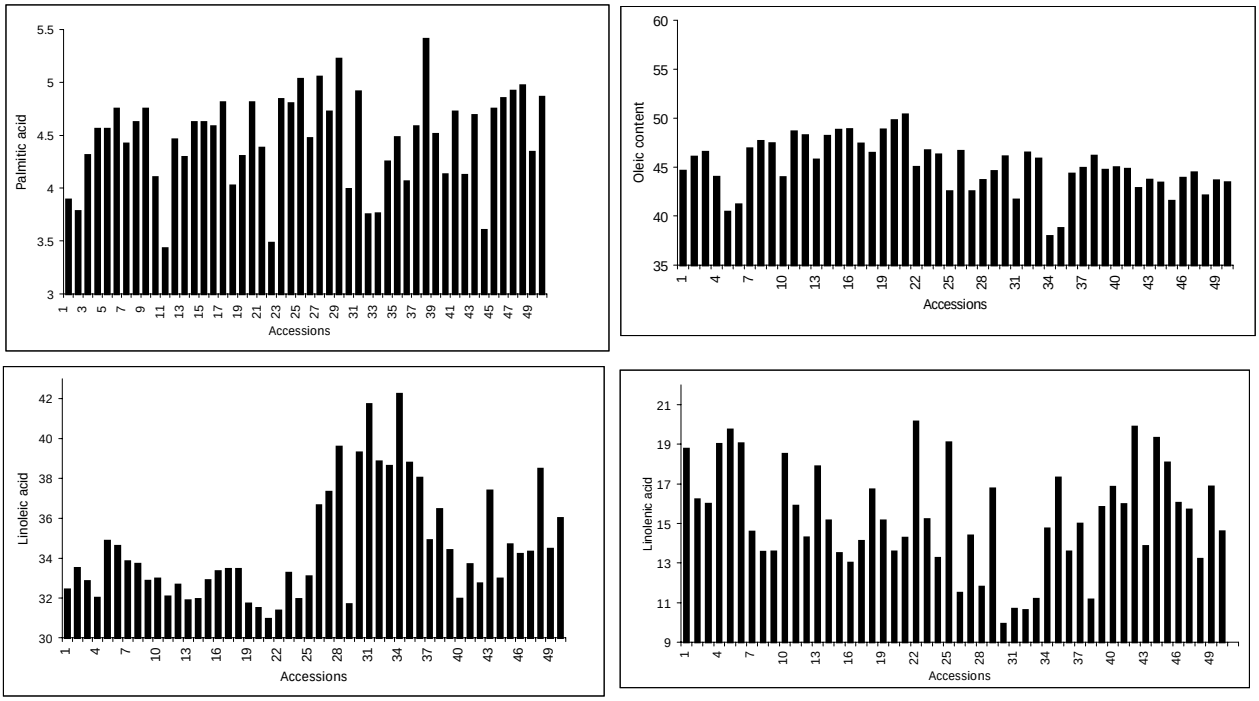

Figure 1. Fatty acid variability recorded in *B. juncea* accessions obtained through inter-and / or intra-specific crosses

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