DEVELOPMENT OF LOW ERUCIC, LOW GLUCOSINOLATE *SINAPIS ALBA*

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ABSTRACT

A cross was made between low erucic, high glucosinolate *Sinapis alba* and normal erucic, low glucosinolate *Sinapis alba* . Open pollinated F_2 seed was planted in the field for single plant harvest. One thousand single plants were analysed for glucosinolate content and the 23 plants with total glucosinolate content less than 10 µmoles/gram were selected for half-seed fatty acid analysis. From these plants 60 seeds were found with less than 1% erucic acid. Further selections have been made in succeeding generations and the success of these is discussed.

INTRODUCTION

Sinapis alba (L) has been successfully grown as a condiment crop on the Canadian prairies, especially Saskatchewan and Alberta under dryland conditions. It has superior heat and drought tolerance in comparison to *Brassica napus* and *B. rapa* canola and is therefore well adapted for production in these areas. *S. alba* is also highly shatter resistant and has a large bright yellow seed. Further advantages include tolerance to blackleg and flea beetle attack. Despite these many advantages yellow mustard is not grown as an oilseed crop in Canada, because the seed normally is relatively high in erucic acid and glucosinolate content and low in oil content (25-28%). However, it has been grown as an oil crop in Sweden (Olsson, 1974). It is now possible to develop a canola quality yellow mustard, because of the existence of a low erucic acid line developed at Saskatoon, a low glucosinolate line developed in Poland (Krzymanski et al., 1991) and a high oil content (36-38% oil) line developed in Sweden (Olsson, 1974). Our objective is to develop a high oil content, low erucic and low glucosinolate cultivar suitable for the Canadian prairies. This paper describes the first step towards this goal, a cross between the low erucic acid line and the low glucosinolate line.

EXPERIMENTAL

Materials and Methods

The glucosinolate content of seed meal was determined by the gas chromatographic method of Thies (1980), except that the glucosinolates were extracted with 65% methanol, the trimethylsilylation was carried out according to the method of Landerouin et al. (1987) and the gas chromatography of the trimethylsilyl derivatives was on a J & W DB-1 (1 µm by 0.32 mm by 15 m) fused silica capillary column (Sosulski et al. 1984) at 280 ° using hydrogen as the carrier gas. The seed meal was prepared by the method of Raney et al. (1987). The fatty acid composition of half seeds was determined by the method of Thies (1971), except that gas chromatography of the methyl esters was performed with a Supelcowax 10 (0.5 µm by 0.32 mm by 15 m) fused silica capillary column at 210 ° using hydrogen as the carrier gas.

The low glucosinolate parental line (92-6669) used was from a single plant selection for zero hydroxybenzyl glucosinolate content and lowest total alkenyl glucosinolate content from the low glucosinolate line obtained from Dr. Krzymanski in 1991 (Krzymanski et al., 1991). The low erucic acid parental line (BHL-926) was half-seed selected for erucic acid content of less than 1.0% erucic. The cross was made between 10 plants of 92-6669 and six plants of BHL-926 in 1992. F_2 seed was produced and planted in a field plant pulling block in 1993. 1000 F_2 plants were harvested and analysed for glucosinolate content by TES-tape and 59 were given a rating of 0 or 1. These 59 plants were analysed by gas chromatography and 36 had a hydroxybenzyl glucosinolate content of less than 0.1 µmoles/g. 23 were selected for half-seed analysis based on lowest glucosinolate content. 36 F_3 half seeds were analysed from each of these plants and 60 half seeds from 14 plants were selected having less than 1% erucic. 52 of these half seeds survived and both selfed and open-pollinated F_4 seed were produced on these plants. The open-pollinated seed of individual plants was analysed for glucosinolate content and 27 were found to have a hydroxybenzyl glucosinolate content of less than 0.4 µmoles/gm. 16 of these plants were selected for further half seed analysis. Selected 46 half-seeds from 14 of these lines with an erucic acid content less than 1%. 205 of the 305 seeds analysed were found to have less than 2% erucic. These 46 seeds have been used in crosses to the high oil content *S. alba* line from Svalof (Olsson, 1974). Selfed seed was also produced on three of these lines. Tables 1 and 2 summarize the glucosinolate and fatty composition data for the parents used in the cross and their progeny.

Discussion

We have been able to successfully combine the low glucosinolate trait of parent 92-6669 with the low erucic acid trait of parent BHL-926 (Table 1 and 2). The material is being grown in 1994 field trials for conformation of this. It should be noted that the low glucosinolate lines, although lacking hydroxybenzyl glucosinolate are slightly higher in both hydroxybutenyl glucosinolate and indolyl glucosinolates. However, it should be possible to reduce these glucosinolates to normal levels with further selections. The fatty acid composition of double low material is not quite canola quality as its linolenic acid content is slightly elevated. It should also be possible to reduce the content of linolenic acid with further selections.

Table 1. Glucosinate content (µmole/g meal ± SD) of parental lines and progeny

Generation (plants)	Hydroxy-butenyl	Total Alkenyl	Hydroxy benzyl	Total Indolyl
92-6669	27.7	28.0	0.0	7.7
BHL-926	2.6	2.6	207.3	1.2
F_1 bulk	4.7	4.7	133.9	2.5
F_2 selected	6.8±2.5	6.9±2.5	0.1±0.0	5.7±2.1
F_3 selected	4.3±3.8	4.5±3.9	0.0±0.1	4.7±2.6

Table 2. Fatty acid composition (% of total ± SD) of parental lines and progeny

Generation (seed)	16:0	18:0	18:1	18:2	18:3	20:1	22:1
92-6669	2.7	1.1	32.8	9.5	11.8	12.0	28.8
BHL-926	3.7	1.9	57.3	11.8	13.6	6.3	4.5
BHL-926 sel. seed	3.4±0.2	1.5±0.3	64.3±2.7	10.7±1.5	16.8±1.8	1.9±0.7	0.4±0.3
F_3 mean	3.3±0.5	1.1±0.2	41.0±14.4	10.7±1.8	15.0±2.5	9.3±3.5	18.3±13.8
F_3 selected seed	3.7±0.3	1.3±0.2	61.5±3.9	11.9±2.0	17.5±2.6	2.7±0.7	0.5±0.3
F_4 mean	4.3±0.7	1.4±0.4	54.2±8.2	14.7±5.2	18.0±3.8	3.8±2.1	2.7±5.3
F_4 selected seed	4.5±1.1	1.5±0.7	58.0±7.7	15.4±5.8	17.2±4.1	2.2±0.6	0.5±0.3
F_5 selfed seed	4.9±0.5	1.7±0.8	56.6±10.7	17.7±5.7	13.8±4.8	3.0±0.5	1.0±0.5

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