REVIEW ON BREEDING OF ETHIOPIAN MUSTARD
(Brassica carinata A.BRAUN)

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Abstract

In a broad sense, our objective in mustard improvement is to develop double low genotype and to combine this characteristics with high yielding capacity. Yield and yield contributing factors are still the main priorities. In Ethiopia, a vast amount of genetic variability exists and about 900 land races are collected and characterized at Holetta. High yielding (both seed and oil) and early cultivars are developed. Recently, zero erucic acid lines were identified from an interspecific cross in collaboration with agriculture Canada Research Station, Saskatoon. Screening of 367 land races for glucosinolate showed few populations with half the normal amount. Allylglucosinolate was the main component. Whether this variation is genetic or environmental is going to be tested. It it is genetic, inbreeding and individual plant selection could be an alternative. Yellow seed coat color resulted in heavier seed weight, higher oil, higher protein and lower crude fibre than non-yellow seeds from similar genetic background. In addition, larger seeds showed similar benefits of oil content and meal characteristics.

Introduction

Ethiopian Mustard (*Brassica carinata* A. Braun n=17, BBCC) is an amphidiploid in the genus Brassica beleived to be originated in Ethiopian high lands (Vaughan, 1956). The species is a natural hybrid between *B.nigra* (n=8, BB) and *B.oleracea* (n=9, CC) followed by chromosome doubling of the hybrid (Pearson 1972). A good fertile hybrid plant was obtained by crossing tetraploid *B.nigra* x tetraploid *B. oleracea* var. *italica* (Pearson 1972). All the three species exist in Ethiopia. A vast amount of genetic variability exist and so far about 900 land races of mustard are collected and characterized at Holetta. The species is best adapted to Ethiopian high lands.

The objective of mustard improvement in Ethiopia is to develop a cultivar with zero erucic acid in the oil and low glucosinolate in the meal and to combine these characteristics with high yielding capacity. Yield contributing factors both genotypic differences and environmental effects are our top priorities, with quality parameters being critically considered. Here yield is meant to say both seed and oil yield.

Seed yield

In Ethiopia oil seeds are divided into three groups based on altitude. In the low land, sesame, peanut and safflower are included. Castor and sunflower are mid altitude crops where as nigerseed, linseed, rapeseed and Ethiopian mustard are high land oilseeds grown for two years at five locations in four replications is shown in table 1. Mustard remains the highest yeelder with in elevations of 2000-2700m above sea level.

Table 1 - Seed yield, oil content, oil yield and seed weight of two cultivars of linseed, nigerseed, rapeseed and Ethiopian mustard grown for two years 1984-85, in four replications at five locations in the Ethiopian highlands.

Crop Species	Seed Yield Kg/ha	Oil Content %	Oil Yield Kg/ha	Seed Weight 1000/g
Linseed				
CL 1525	1287	36.6	471	5.6
CL 1652	1233	36.8	453	5.8
Niger seed				
Sendafa	620	37.9	234	3.1
PGRC/E 015585	640	38.3	245	2.9
Rapeseed				
Tower	1660	46.1	765	3.4
Pura	1585	45.1	714	3.3
Mustard				
Dodolla	2590	44.4	1150	4.2
PGRC/E 021148	2606	43.7	1139	3.9

Recently, we observed infestation of mustard and rapessed with *Orobanche ramosa* (IAR 1976-85). The extent of damage is not studied. However, we are planning to screen our germplasm in search of resistance. Other grass and broad leaved weeds are hand weeded. Mustard is generally latter to flower and mature probably due to major breeding work towards earlyness was not done. Characterization of our germplasm has resulted in genotypes as early as rapeseed (IAR 1976-85). So far five high erucic and high glucosinolate cultivars are developed.

OIL CONTENT AND QUALITY

The oil content of mustard under Holetta environment ranges 37-51% (IAR 1976-85). The characteristic is influenced very much by environment (Westphal 1973). Generally oil content increases with altitude or decrease of temperature. In addition the oil content is influenced by see size and color (Getinet 1986). Yellow seeds result in higher oil, higher protein, low crude fiber contents and heavier seed weight that non-yellow seeds from similar genetic background.

Also larger seeds showed similar quality characteristics.

Fatty acid composition of 17 mustard brown seeded accessions grown at Holetta in 1983 is shown in Table 2. It is clear that erucic, eicosenoic and linolenic fatty acids are too high and linoleic acid is low as compared to oils from composite such as sunflower. The fatty acid composition of these lines grown at Saskatoon, Canada showed little variations. Generally erucic acid is considered unwanted and linolenic acid reduces keeping quality (Vaisey and Michael 1982). Linoleic fatty acid is vital for many of body functions.

Recently, zero erucic, low eicosenoic and high linoleic and linolenic fatty acid lines of mustard are identified from an inter-specific cross of *B. carinata* CV S-67 X *B. juncea* zero erucic acid mustard (ZEM 2330). These lines are semi sterile and are in a back-crossing programme to restore fertility. These are going to be our gene sources.

Table 2 - Fatty acid composition of oil from open pollinated seed of brown seeded lines derived from 14 accessions and two cultivars of mustard grown at Holetta in 1982.

Cultivar/ Line	Fatty Acid %*					
	Palmitic	Oleic	Linoleic	Linolenic	Eicosenoic	Erucic
21156	2.9	9.3	19.3	15.3	8.7	40.0
21164	3.0	10.0	16.6	16.2	10.5	39.7
21224	2.7	10.1	16.1	17.0	9.8	41.1
21236	2.9	8.6	14.8	15.0	9.8	41.1
21257	3.0	9.9	16.3	14.3	10.4	43.9
21324	2.9	11.0	18.0	14.3	11.4	38.3
21326	3.2	9.8	16.9	16.9	1.6	40.3
200403	3.0	9.7	16.2	15.5	10.8	40.7
200405	2.9	10.0	19.1	13.3	10.2	42.2
200407	2.9	9.6	17.5	24.0	9.3	42.3
200416	2.8	10.1	15.9	15.0	9.5	42.7
200417	2.7	11.1	15.8	15.7	9.7	41.2
200420	2.8	10.1	17.6	16.6	10.4	39.4
200423	2.8	10.8	17.8	14.8	10.2	40.0
Dodala	2.8	9.5	16.5	14.2	9.8	43.2
S - 67	2.6	12.2	18.7	12.1	9.3	42.3
Mean	2.9	10.0	17.0	15.1	9.9	41.4

* Fatty acids expressed as percent of total fatty acids.

MEAL QUALITY

The meal of mustard contains about 40% Protein and 8% crude fibre (Getinet 1986). However, the meal is characterized by high level of allylglucosinolate. Much has been said about the nature and properties of glucosinolates.

Screening of land races for glucosinolates using taste tapping, followed by Gas chromatograph analysis of TMS derivatives showed few lines with half the normal amount (Table 3). Whether this is genetic or environmental is going to be studies. If it is genetic inbreeding followed by single plant selection could be an alternative.

R E F E R E N C E S

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Table 3 - Glucosinolate Content and Pattern of Four *B. carinata* Populations selected as relatively Low out of 867 Collections Grown in 1984.

Population	Glucosinolate (Micromoles/gram oil extracted Meal)								
PGRC/E	Allyl	But	Pent	Hobut	Hopent	Hobenz	Ind	Hoind	Total
208539	75.57	0.30	0.14	1.12	0.12	0.34	0.12	4.30	82.10
208531	68.55	0.32	0.08	1.22	0.08	0.25	0.05	5.52	76.07
207923	108.69	0.57	0.08	1.23	0.07	0.07	0.32	0.04	111.07
208494	118.42	0.59	0.14	1.18	0.05	0.17	0.04	7.23	127.82

Allyl = Allylglucosinolate
But = 3 - Butenylglucosinolate
Pent = 4 - Pentenylglucosinolate
Hobut = 2 - Hydroxy 3 - butenyl glucosinolate
Hopent = 2 - Hydroxy 4 - Pentenyl Glucosinolate
Hobenz = P - Hydroxy benzylglucosinolate
Ind = Indoglucosinolate
Hoind = Hydroxy Indolglucosinolate
PGRC/E = Plant Genetic Resource Center/Ethiopia