Review of Mustard/Rapeseed Breeding Research in Ethiopia

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Introduction

There are three species of oilseed *Brassica* currently under investigation by the Highland Oil Crops Improvement Team (HOCIT).

Ethiopian mustard *(Brassica carinata)* is one of the main oil crops of Ethiopia. It is widely grown by small farmers in more fertile, well drained areas often close to their houses. It is important as a source of oil and leafy vegetable in mid-altitude and highland areas from 1650 to 2600 meter above sea level. Main areas of production are Gojjam, Arsi, Sidamo, Eastern Wolega, Central and Southern Shoa.

Although Argentine rapeseed *(B. napus)* has been grown in many countries for a long time, it was introduced into Ethiopia about 13 years ago on an experimental basis from northern Europe and Canada. This species has the advantage of being earlier and more uniform than *B. carinata* and may be more suitable for mechanized harvest. Rapeseed is being promoted for large scale production in the highlands of Arsi and Bale.

Turnip rapeseed *(B. campestris)* is the fastest maturing *Brassica* species, and may have potential in the short rainfall areas around Mekele.

In this paper, an attempt has been made to review the research done on breeding aspect and to give recommendation and propositions for increasing the production of oilseed *Brassica* in the country. A brief account of results obtained and the progress on rapeseed/mustard breeding/selection follows.

Lines of Investigation

The oilseed *Brassica* breeding programme is aimed to develop improved cultivars with minimal frost damage and resistance to *Alternaria* leaf spot and stagheads produced by downy mildew and white rust. The different oil and meal quality needs for subsistence and commercial production have been considered when back crossing and selecting cultivars for erucic acid and for glucosinolate content.

Table 1 – Summary of Seed Yield, Seed Oil Content and Seed Oil Yield of the varieties in Linseed, Rapeseed and Mustard National and Extension Yield Trials (1981-83)

Crop	Variety	Seed Yield (kg/ha)		Oil Content (%)		Oil Yield (kg/ha)		Erucic acid (%)	Year of Release
		*F_0	*F_1	F_0	F_1	F_0	F_1		
Rapeseed	Tower	686	1814	46.3	47.3	318	858	0-2	1984
	Pura	730	1950	46.5	47.9	339	934	0-2	1984
	Target	905	1952	47.6	47.4	431	925	47.4	1976
Mustard	S - 67	1450	2040	38.5	38.9	558	794	53.4	1977
	S - 71	1349	2191	39.6	39.2	534	859	53.2	1976
	S - 115	1356	1983	38.4	39.4	521	781	–	1977
	Awassa Pop	1372	2180	39.3	39.6	539	863	51.9	1977
	Dodolla	1469	2153	39.7	40.9	583	881	49.1	1980
	Local check	644	929	38.6	37.4	249	347	–	–

*F_0 and F_1 denote unfertilized and fertilized respectively.

Results and Progress

In the past, the effort was directed to the fullest exploitation of promising local cultivars. Evaluation of 864 Ethiopian landraces and several introductions led to the release of five *Brassica carinata* varieties (S-67, S-71, S-115, Awassa Population and Dodolla 1) and three *Brassica napus* varieties (Target, Tower and Pura). Target has high erucic acid and high glucosinolate level similar to those of the released Ethiopian mustards *(B. carinata).* On the other hand, the rapeseed varieties, Tower and Pura are equal in seed yield and superior in oil quality to Target (Table 1). At the present time, there are no released varieties of *B. campestris.* Multi-locations trials showed that, under long growing season condition, Ethiopian mustards outyields rapeseed. At sites where maturity was accelerated, seed yields of *B. carinata* and *B. napus* were similar. Seed yields of *B. campestris* were low at all sites.

The major effort in the crossing programme has been toward incorporating earliness, low erucic acid and low glucosinolate characters into local mustard selections. Interspecific crosses have been achieved and are being used to broaden the genetic basis of Ethiopian mustard.

Brassica carinata (Ethiopian mustard) can yield more than any other *Brassica* species. However, both erucic acid levels (Table 1) and glucosinolate content are high in *carinata.* While the scientific aspect of the dangers of erucic acid may not be too clear cut, there is no doubt of the commercial strength of the move to low erucic acid varieties of oilseed *Brassica.* The reduction of glucosinolate will improve the quality of the meal (oil cake) to be fed to livestock and increase its value in international markets. Thus for export purpose there would certainly be advantages in having low erucic and low glucosinolate varieties.

In the development of zero erucic *B. carinata,* the use of crosses with zero erucic acid lines of both *B. napus* and *B. juncea* is pursued. In 1975, 1977 and 1981, a number of varietal and inter-specific crosses were made involving *B. carinata* (S-67, S-71, S-115, Awassa pop, Dodolla, PGRC/E 21067 and 11 early maturing Ethiopian mustard) and *B. napus* (Regent, Altex and Tower) to get desirable segregants with respect to earliness, erucic acid levels and glucosinolate content. Eight true F_1 hybrids between *B. napus* x *B. carinata* were obtained from 300 crosses of 1981. This is a success rate of 2.6 % better than reported in literature. All F_1 hybrids were completely self sterile, which is common in inter-specific crosses. Successful backcrosses were made using carinata as the recipient parent. Crosses were also made in 1982 between double zero *B. juncea* (Zem-1 and Zem-2) and *B. carinata* (Fig. 1). The same *carinata* parents had been used as in *napus* x *carinata* crosses. Bc_1 F_1 seed from both *napus* x *carinata* and *juncea* x *carinata* crosses were planted at Holetta in 1983. These crosses were both selfed as well as back crossed to the respective *carinata* parents. In 1984, all back cross plants were planted in progeny rows and the mustard type progenies were bagged and harvested.

Some of the constraints of rapeseed and mustard production is the lack of varieties resistant to insect pest and in some areas to Orobanche (broom rape). There is a good collaboration between the breeders and the scientists involved in crop protection in screening germplasm and advanced material against insect pests and parasitic weeds.

Summary and Recommendation

Good work has been done on varietal improvement. The varieties released so far are the product of straight selection from local collections and introductions. For better yield, it is necessary to plant sound seed of the released varieties on properly prepared seed-bed with good drainage. Seed treatment with proper chemical can protect the crop from disease and insect pest especially flea bettle.

One of the most serious constraints of rapeseed-mustard production is the lack of varieties resistant to insect pests. To save the crop from pests, it is essential to watch the field during growth for insect and undertake timely plant-protection measure.

Efforts are being made to incorporate genes for low erucic acid and glucosinolate levels into *B. carinata.*

Figure 1 – Genome relationships of some economically important Brassica species