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Selection of Earlier Flowering Mutants From Canola (Brassica Napus L.) CV. SERW 4

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ABSTRACT

This research work was conducted during three winter seasons; 2011/2012, 2012/2013 and 2013/2014 at the Experimental Farm of South Valley University, Qena to select for early flowering among 17 canola (Brassica napus L.) promising mutants and evaluation the selections under saline new reclaimed lands conditions . They were isolated from M2 generation after seed treatment of canola variety i.e. Serw 4 by 15 Kr of gamma rays. In the M3 generation Selection was practiced based on early flowering compared to the mother parent. Ten mutants were selected and evaluated in two preliminary trials with their mother parent and chick variety i.e. Serw 6. All mutants were found to be significant earlier than the parent and the chick variety in two trials and their combined. But they shown decreasing in means performance for most other studied traits compared to the mother and chick variety. From the combined data the mutants; M11-2-4 and M11-2-1 were found to be the best in earliness with good performance in most other traits. In conclusion, these two earlier mutants must be put into more future advanced evaluation trials in different locations before registration.

KEYWORDS Canola . Selection . Early flowering . Mutants

INTRODUCTION

Egypt faces great dificults in providing the requirement of the population from edible oils, where, the amount of imports ranged roughly from 95 to 97% of all consumption (Anonymous 2013). The little production of vegetable oils in Egypt is due to small of the cultivated area by oilseed crops. In addition, most of vegetable oils in Egypt come from cotton seed and the rest part comes from soybean and sunflower seeds, where, the sesame and peanut seeds are consumed directly without oil extraction (Abdel-Aziz Kandil, 1998). So, it must be make more efforts to increase the local production and narrowing the gap between production and consumption. Canola (Brassica napus L.) is considered an important oilseed crop ranking third only to soybean and palm oil in world production (Rahimi and Bahrani, 2011). Expansion in the cultivation of canola in Egypt, especially in the new reclaimed lands because of its ability to grow under wide soil variations (e.g. drought, salinity….), is one of the tools that contribute in reducing oil shortage,. In addition, it could be grown successfully in winter season in Egypt, therefore, its water requirements is low compared to the other oilseed crops such as sunflower and soybean which are grown in summer season. Therefore, it can be grown in the project of Southern Egypt, where the difficulty of grown the summer oilseed crops because of harsh climate in this region. On the other hand, development short season cultivars are considered an important objective, where the earliest cultivars aid to fit in crop intensive rotation by cultivation of more times in the same area and season. Mutation breeding is considered as one of the breeding methods that used in improvement different crops. Two thousand two hundred and fifty-two mutant varieties of different crops with improved agronomic traits such as earliness, high oil content and stress tolerance have been officially released and recorded in the FAO/IAEA Mutant Varieties Database before the end of 2000 (Maluszynski et al., 2000). Induced mutation has been also successfully used for genetic improvement of/any yield components in rapeseed (Abdullah Khateri et al., 2005; Sourour and Keshta, 1994; Muhammad Aslam Javed et al., 2003 and Sheikh et al., 2009). In addition, some early maturity mutants in rapeseed were developed by Sanjay and Joshua (1999), Barve et al. (2009) and Malek et al. (2012)).

The present study aimed to apply one cycle of selection for early flowering on promising mutants isolated from M2 generation and evaluation the selections under saline soil conditions.

MATERILS AND METHODS

EXPERIMENTAL SITE DESCRIPTION:

This work was conducted at the Experimental Farm of South Valley University, Qena, Egypt (26°11'N and 32°44'E) during three winter seasons i.e., 2011/2012, 2012/2013 and 2013/2014. Soil of the Experimental Farm is new reclaimed lands irrigate by underground water. The soil and irrigation water salinity (EC_e) were 13.99 and 7.71 ds m^{-1}, respectively.

MUTANT SELECTION AND DEVELOPMENT:

The materials used were 17 early flowering promising mutants isolated from M2 generation after seed treatment of canola variety i.e. Serw 4 with 15 Kr of gamma rays. During 2011/2012 season, the 17 mutants were grown, each mutant in four rows. Selection was applied and 10 out of the 17 mutants were selected based on earliness in flowering. The selected mutants with their parent i.e. Serw 4 and check variety Serw 6 were evaluated in two preliminary trials during 2012/2013 and 2013/2014 seasons.

EXPERIMENTAL DESIGN AND AGRONOMIC PRACTICES:

A randomized complete block design with three replicates was used in the preliminary trials. The experimental plot included three rows each 3 m. long and 50 cm. apart, sowing was in hills spaced 10 cm. All the agricultural practices were used as recommended.

MEASUREMENTS:

In each plot, earliness was recorded as number of days from sowing to flowering of 50 % of plants (NDF). At harvest, 15 plants were harvested and data on plant height (cm.) (PHt), number of siliquas $plant^{-1}$ (NSP), 1000 seed weight (g.) (SI) and seed yield $plant^{-1}$ (g.) (SYP) were measured. Seed oil content (oil %) was estimated by Soxhelt apparatus according to A.O.A.C. (1980).

STATISTICAL ANALYSIS:

Data were statistically analyzed using analysis of variance for randomized complete block design (RCBD) for each preliminary trial, separately. Combined analysis over the two trials was also done after testing the homogeneity. Statistical analysis was done according to Gomez and Gomez (1984). Mean comparisons were performed using Revised Least Significant Differences (Revised L.S.D.) test.

RSULTS AND DISCUSSION

SIGNIFICANCE OF MEAN SQUARES

High significant differences were observed among mutants/

varieties for earliness and the other studied traits in M4, M5 and their combined (Table 1). These results indicated that, the applied selection for earliness was effective and the variations were genetic and true. Combined analysis showed that, the seasonal differences were highly significant for all studied traits with exception, earliness which was significant and each of number of siliquas plant^{-1} and seed oil content which were insignificant. These results indicating that the selected mutants were unstable during seasons for some studied traits. This may be due using early generations for evaluations (M4 and M5) and need to more advanced generations to study and evaluation. In this line, significant differences were observed among all isolated mutants for the studied quantitative traits under evaluation preliminary trails in M3 and M4 generations (Muhammad Aslam Javed et al., 2003 and Abdullah Khatri et al., 2005).

PERFORMANCE OF MUTANTS

Earliness (NDF): Data of performance of earliness for the ten evaluated promising mutants, their parent and the check variety are presented in Table (2) and illustrated in Fig. 1.

It seems clearly that, all mutants were found to be significant earlier than parent and check variety in M4, M5 and their combined (Table 2). The earliness period ranged from; 6 to 23, 15.67 to 25.67 and 11.5 to 23 days over their parent in M4, M5 generations and their combined, respectively. Out of these earlier mutants, the three mutants; M11-2-4 (66.17 days), M11-2-1 (67 days) and M11-4-1 (67.17 days) were came in the first. These three mutants were earlier by (23.5, 22.67 and 22.5 days) and 22.5, 21.67 and 21.5 days) over their parent and check variety, respectively. These results indicated to successful of selection for development earlier mutants. In this connection, an early flowering mutant in mustard line (DLJ-3) was isolated by Syed et al. (2005). In addition, several early maturing mutants in rapeseed were developed by Das et al. (1999), Sanjay and Joshua (1999), Barve et al. (2009), Malek and Monshi (2009) and Malek et al. (2012) which confirm the obtained results.

Plant height (PHt): The results indicate that, all mutants were observed as shorter than the parent and check variety in both preliminary trials and their combined (Table 2). In this connection, Olejniczak and Adamska, (1999) reported that, the dwarfness in plant height is associated with earliness in maturity. In addition, five early flowering dwarf mutants were obtained by Barve et al. (2009).

Siliquas/plant (NSP): It is clear from the obtained results, reduced number of siliquas/plant with all mutants compared to the parent and check variety in both preliminary trials and their combined (Table 2). This reduction may be due to dwarfness in plant height which mostly accompanied by reduction in branches/plant.

Table 1: Significance of mean squares due to different sources of variation for studied traits in M4, M5 generations and their combined.

	M4 generation			M5 generation			Combined			
Source of variation	Reps.	Mut./ Var.	Error	Reps.	Mut./ Var.	Error	Gen. (a)	Mut./Var. (b)	a x b	Error
Degrees of freedom	2	11	22	2	11	22	1	11	11	44
Mean squares										
Trait	Mut./Var.		Error	Mut./Var.		Error	Gen. (a)	Mut./Var. (b)	a x b	Error
NDF	194.45 **		3.78	196.69 **		5.23	32 *	369.45 **	21.7 **	4.5
PHt	220.84 **		8.63	172.01 **		9.64	129.34**	363.17 **	29.68 **	9.13
NSP	4049.97 **		96.51	6540.27 **		104.79	25.68	8158.65**	2439.62 **	100.72
SI	1.86 **		0.15	2.53 **		0.10	1.53 **	2.25 **	2.13 **	0.10
SYP	8.8 **		0.33	23.46 **		0.25	4.05 **	17.41 **	14.82 **	0.29
Oil %	17.46 **		1.09	24.40 **		1.00	0.67	25.57 **	16.29 **	1.05

*** and ** significant at 5 % and 1 % probability level, respectively**

Table 2: Mean performance of mutants/varieties for earliness and the other studied traits in M4 and M5 generations and their combined.

Generation	Traits / Mutants/ varieties		NDF (days)	PHt (cm.)	NSP	SI (gm.)	SYD (gm.)	Oil %
M4 generation	Serw 4 (Parent)		88.67	82.10	207	3.30	10.96	38.03
	Serw 6 (Check V.)		89	80.00	164.67	5.40	8.90	40.05
	M11-1		74.67	61.60	162	5.10	11.25	36.42
	M11-2-1		70	56.00	127.33	5.00	7.56	32.66
	M11-2-2		82.67	60.17	132.67	3.80	9.25	35.17
	M11-2-3		77.67	68.10	113.67	4.90	8.03	36.68
	M11-2-4		65.67	61.90	107	5.60	7.24	38.29
	M11-3		70.67	63.80	87	5.40	6.72	39.15
	M11-4-1		68.33	55.47	91.67	5.20	5.81	37.54
	M11-4-2		68	58.00	79	4.80	6.59	39.01
	M11-6		70	68.97	129	5.20	8.69	41.88
	M11-7		71	65.80	120.67	6.00	9.65	39.28
	Revised L.S.D. at	5%	2.86	4.44	14.44	0.61	0.87	1.61
		1%	3.82	5.90	19.25	0.82	1.16	2.13
M5 generation	Serw 4 (Parent)		89.67	71.40	168.60	5.60	8.62	38.96
	Serw 6 (Check V.)		88.67	80.77	233.80	3.80	13.08	43.67
	M11-1		73.67	57.47	75.87	3.90	4.81	37.26
	M11-2-1		64	53.60	124.80	5.10	10.98	36.36
	M11-2-2		72.67	56.67	170	4.90	9.91	40.82
	M11-2-3		74	59.90	119.57	6.10	8.08	32.69
	M11-2-4		66.67	60.50	142.27	4.10	10.49	41.07
	M11-3		68.67	66.07	107.40	4.60	6.79	38.75
	M11-4-1		66	55.27	69.60	5.60	5.29	36.36
	M11-4-2		70.33	63.37	82.90	6.30	3.88	36.94
	M11-6		72	63.50	106.30	6.10	7.14	37.22
	M11-7		74	61.20	133.70	6.10	5.88	36.38
	Revised L.S.D. at	5%	3.37	4.75	15.05	0.48	0.72	1.51
		1%	4.49	6.38	20.06	0.64	0.96	2.02

Combined	Serw 4 (Parent)		89.17	76.75	188	4.45	9.79	38.50
	Serw 6 (Check V.)		88.83	80.38	199.33	4.60	10.99	41.86
	M11-1		74.17	59.53	119	4.00	8.03	36.84
	M11-2-1		67	54.80	126.17	5.05	9.27	34.51
	M11-2-2		77.67	58.42	151.33	4.35	9.58	37.99
	M11-2-3		75.83	63.98	116.83	5.50	8.05	34.68
	M11-2-4		66.17	61.20	124.50	4.85	8.87	39.68
	M11-3		69.67	64.93	97.17	5.00	6.75	38.95
	M11-4-1		67.17	55.37	80.67	5.40	5.55	36.95
	M11-4-2		69.17	60.68	81	5.55	5.24	37.98
	M11-6		71	66.23	117.67	5.65	7.91	39.55
	M11-7		72.50	63.50	127.17	6.05	7.76	37.83
	Revised L.S.D. at	5%	3.04	4.35	14.41	0.47	0.77	1.51
		1%	4.01	5.73	19	0.62	1.02	1.99

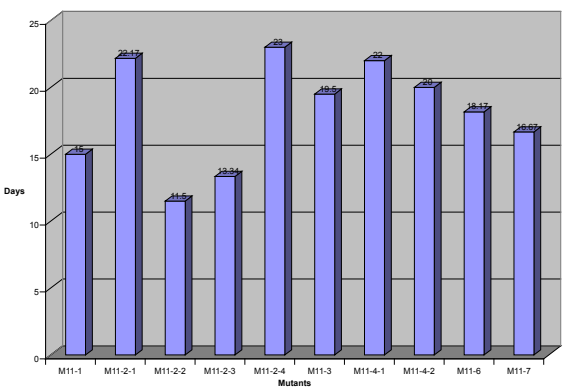

Fig. 1: Earliness period of the ten mutants over their parent (from the pooled data)

1000-seed weight (SI): Most mutants had highest values of SI compared to the parent and check variety over the two preliminary trails (Table 2). Furthermore, the three superiority mutants in earliness were produced higher values of SI than their parent and check variety. The increase in SI may be due to an increase in seed size as a result of reducing of NSP.

Seed yield/plant (SYP): Combined data revealed that, all mutants had the same trends, that observed with the above-mentioned traits where they recorded lowest values of seed yield/plant compared to the parent and check variety (Table 2). But it is noticed that out of the three superiority mutants in earliness, the two mutants; M11-2-1 and M11-2-4 showed good performance in seed yield/plant (9.27 and 8.87 gm., respectively). Abdullah Khateri et al. (2005) and Barve et al. (2009) developed earlier mutants, most of them had heaviest seed yield, however the others have shown decreasing in the values of seed yield.

Seed oil content (oil %): Results of pooled data indicated that, most of the mutants have shown decreasing in the values compared to the parent and check variety (Table 2). The mutants; M11-2-4, M11-6 and M11-3 had insignificant increasing over their parent where they recorded 39.68, 39.55 and 38.95 %, respectively. Similar results were obtained by Muhammad Aslam Javed et al. (2003) who developed the two mutants; TS95-1005 and TS96-752 which showed insignificant increasing in oil content over their parent.

CONCLUSION

Results of this study demonstrate successful of one cycle of selection for earliness in development ten earlier canola mutants. Mostly, all mutants have shown decreasing in means performance for most other studied traits compared to their parent and check variety. From combined data, the mutants; M11-2-4 and M11-2-1 were found to be superior in earliness with good performance in most other traits. In general, we recommend putting these two earlier mutants into more future advanced evaluation trials in different locations before registration.

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