J. Agric. Sci. Mansoura Univ., 25 (6): 3295 - 3301, 2000.

STUDIES ON THE VARIABILITY AND GENETIC ESTIMATIONS OF SOME STRAINS OF RAPESEED (*Brassica campestris* L.)

Abou-Ghazala, M.E.
Oil Crops Res. Section, Field Crops Res. Inst. A.R.C.

ABSTRACT

The present investigation was carried out in two locations (Sakha and Nubaria Research Stations, ARC) during the two growing seasons 1997/98 and 1998/99 to evaluate and study some genetic parameters of nine strains of rapeseed (*Brassica campestris* L.). The results indicated the presence of significant differences between these strains. The two strains Int. 330 and Int. 185 were found to be the highest yielding per plant. The results concluded that the genotype by year interactions were significant for all studied characters. The same trend was observed for genotype by location interactions except of yield per plant.

Phenotypic and genotypic coefficient of variability (P.C.V. and G.C.V.), heritability (broad sense) and expected genetic advance for the studied characters indicated that a wide range of phenotypic variation was noticed in studied characters. High heritability estimates were observed for number of days to flowering and seed yield per plot. This finding indicating that a large part of the observed variability among strains for these characters were due to genetic differences. On the other hand the other characters indicated moderate and low estimates of heritability. The expected genetic advance under selection appeared to be effective and ranged from 10.19 to 32.77.

INTRODUCTION

Many Brassica species have been cultivated since pre-historic times for their edible roots, stems, leaves, buds, flowers and seeds. Within the species, crops have been developed for different purposes. Production and usage of Brassica oil seed have grown faster in the period 1975-1985 than any other oil crops (Downy *et al.*, 1989). From the edible oil point of view. Brassica oil was legally added as an edible oil in Egypt if the erucic acid is lower than 2% (El-Ahmer, 1989). Three species have been experimented on and gave good results in Egypt. These were *B. napus, B. campestris* and *B. Juncea*. The first two are referred to as rapeseed or canola. Only the spring types can do well under Egyptian environment. The demand for vegetable oils and fats has been increasing with the increase in population but the country produces only about 15% of total needs. There was an urgent need to bridge gap between local production and the export market through exploring new oil crops. The Brassica species have wide adaptability and perform well under a wide range of climates. The preliminary informations of the economic characters in *Brassica* spp. under Egyptian environment is too limited. Evaluation of promising strains is an important and necessary step for the development of improved Brassica strains. The evaluation of promising breeding strains requires to repeat testing in both of seasons and locations, due to genotype x environment interaction. The objectives of this work were:

1) Evaluation the performances of the nine strains of rapeseed (*B. campestris* L.) at two locations in two successive seasons, and
II) Estimation the heritability and genetic advance of the studied characters.

MATERIALS AND METHODS

This study was carried out at the Agricultural Research Stations, Sakha and El-Nubaria, Agric. Res. Center during the winter seasons of 1997/98 and 1998/99. The materials used in this study included nine strains of rapeseed (*Brassica campestris* L.) (Int. 161. Int. 165, Int. 182, Int. 183, Int. 184, Int. 185, Int. 186, Int. 190 and Int. 330), collected from the stock of Oil Crop Res. Se. EFCRI, ARC are presented in (Table 2).

A randomized complete blocks design with four replications was used. The experiment was sown in plots (9.6 m^2) on ridges 0.6 m apart and 10 cm between plants. Seeds were sown in the second week of November 1997 and 1998. After 25 days from sowing, plants were thinned leaving one plant per hill and N. fertilizer at the rate of 60 kg N./feddan was added with the first and second irrigations. Irrigations were carried out at 25 days intervals except during the rainy days. Plots were hoed two times before the first and the second irrigations. All recommended cultural practices of rapeseed were adopted throughout the growing season. Harvesting was carried out in the last week of March 1998 and 1999.

The recorded data were:

1- Number of days from sowing to flowering, 2- Plant height (cm), 3- Number of primary branches, 4- Seed yield per plant (gm) and 5- Seed yield per plot measured on plot mean basis (harvested area 3.6 m^2).

Means were compared using the New Least Significant Differences (N.L.S.D.) test as described by Waller and Duncan (1969). To study the (genotype x environment) interactions a combined analysis of variance was made for each character over the two years according to Cochran and Cox (1957), and Steel and Torrie (1980).

Genetic parameters for all studied characters were calculated using the components of variances from the expected mean squares as described by Johnson *et al*. (1955). The heritability values, in the broad sense, were calculated using the formula given by Rasmusson and Glass (1967). While, the genetic advance (GA) was estimated according to Fehr (1987).

RESULTS AND DISCUSSION

1.Number of days to flowering:

The data of combined analysis of variances are presented in (Table 1). The results indicated that highly significant differences among genotypes were obtained for number of days to flowering. The genotypes Int. 184 and Int. 185 recorded lower number of days to flowering (Table 2). The great effect of interactions between location and years indicated that rapeseed as an average of all genotypes responded relatively better at some locations in some years than it did in other years. Since genotype differences were not part of this comparison, this interaction has no relationship to recommendations with respect to genotypes.

The results indicated that highly significance differences between genotypes were obtained. The results also indicated that the first order interactions of genotypes x years and genotypes x locations and the second order interaction of genotypes x locations x years, were all significant. These might be interpreted that the nine genotypes under study (or some) reacted differently in different locations, in different years, and in certain locations in certain years. However, the results also indicated that the interaction variances, even they were significant-but their magnitudes were very small in relation to the genotypic variance which greatly exceeded the interaction variances indicating that some of the nine genotypes under study were significantly superior to others. These results are in agreement with the results obtained by Ram and Yadava (1992).

Table (1):Combined analysis of variance for the studied characters in rapeseed after evaluation at two locations in two seasons.

		Mean squares				
Source of variation	**d.F**	**Days to flowering**	**Plant height**	**No. of primary branches**	**Seed yield per plant**	**Seed yield per plot**
Years (y)	1	455.111**	11972.00**	1.156	5.355**	769.138**
Locations (L)	1	348.444**	126.56	106.950**	0.129	13552.840**
Y x L	1	2483.361**	69740.00**	133.590**	2.320**	144.801**
Y x L. x Rep.	12	21.977	318.303	1.005	0.067	36.409*
Genotypes (G)	8	2150.663**	1441.920**	14.543**	0.343**	207.101**
Y x G	8	150.861**	380.383*	12.317**	0.096*	112.969**
L x G	8	188.413**	596.406**	6.426**	0.063	159.083**
Y x L x G	8	50.674*	197.413	7.062**	0.079	158.089**
Error	96	20.248	186.022	1.846	0.043	18.594

*** = Significant at 0.05 level. ** = Significant at 0.01 level.**

2. Plant height:

The combined analysis of variances are shown in (Table 1). Highly significant differences between genotypes were obtained. The Int. 165 followed by Int. 161 genotypes recorded the tallest plants, (Table 2). The results also indicated that the first order interaction was significant with sizeable magnitude of variance due to genotypes x locations indicating that some genotypes reacted differently in different locations and the differential genotype response might be due to location effects rather than year effect. The second order interaction was insignificant. These results are in agreement with the results obtained by Badwal *et al.* (1983) and El-Ahmer *et al*. (1994).

3. Number of primary branches:

The combined analysis of variance (Table 1) revealed highly significant differences among genotypes. The Int. 165 strain showed the highest number of primary branches (Table 2). The results also, indicated that the first order interactions of genotypes x years and genotypes x locations, and the second order interaction of genotypes x locations x years, were highly significant, this means that the evaluated rapeseed genotypes must be evaluating at several locations for several years, taking in consideration the genotype performance on the individual tests before giving recommendation for a certain location. These results are coincidence with those reported by Ram and Yadava (1992) and El-Ahmer *et al*. (1994).

Table (2):Means of the agronomical characters of studied genotypes of rapeseed at two locations in two successive seasons.

No.	Strains	Mean squares				
		No. of days to flowering	**Plant height (cm)**	**No. of primary branches**	**Seed yield per plant (gm)**	**Seed yield per plot (kg)**
1	Int. 161	87.9 a	141.3 a	6.9 ab	14.0 c	1.190 a
2	165	86.0 a	145.5 a	7.3 a	15.2 c	1.09 a
3	182	67.4 b	126.3 bcd	5.7 c	13.6 c	0.834 bc
4	183	67.3 b	123.6 bcd	6.6 abc	14.1 c	0.851 bc
5	184	56.6 d	118.6 cd	6.9 ab	19.5 b	0.738 c
6	185	57.1 c	116.8 d	6.8 ab	20.9 ab	0.825 bc
7	186	61.2 c	128.3 b	6.1 bc	19.3 b	0.796 bc
8	190	66.3 b	127.6 bc	6.9 ab	18.6 b	0.911 b
9	330	60.4 c	130.4 b	6.5 abc	23.8 a	0.857 bc

Values followed by the same alphabetical letter(s) is (are) insignificant at 0.05 level of probability.

4.Seed yield/plant:

The data of combined analysis of variances are presented in Table 1. Significant differences were obtained between years, while insignificant was found between locations. The studied genotypes differed significantly in seed yield/plant. The genotypes Int. 330 and Int. 185 produced the highest seed yield/plant, while Int. 182, Int. 161 and Int. 183 were the lowest genotypes in seed yield/plant as shown in (Table 2). The superiority of such genotypes could be due to their adaptation and high values of some yield components. The results also indicated that the first order interaction of genotypes x years was significant, while the genotypes x locations was insignificant. The second order interaction was also insignificant. This means that some genotypes, as an average for all locations, yielded better in some years whereas others were less productive in the different years. Unless the average differences between varieties overall years is greater than the interaction of genotypes x years, a recommendation cannot be made for any one genotype for all seasons. However, because the mean square for genotypes is greater than the mean square for genotypes x years, some genotypes may be considered superior to others. These results are in agreement with those obtained by Huehn and Léon (1983), Priya and Singh (1983), Thakur *et al*. (1992) and El-Ahmer *et al*. (1994).

5. Seed yield/plot:

The data of combined analysis of variances are presented in (Table 1). Highly significant differences among genotypes were obtained for seed yield/plot. The results indicated that this character significantly affected by years and locations. The highest seed yield/plot was obtained by Int. 161 followed by Int. 165. The first order interactions revealed that performance of genotypes differ from year to year and from location to another. The second order interaction genotypes x locations x years interaction was also highly significant indicating that the rapeseed genotypes under study responded differently under different environments. These results are in agreement with those obtained by Priya and Singh (1983), Thakur *et al*. (1992) and El-Ahmer *et al*. (1994).

Estimates of phenotypic and genotypic coefficients of variation, broad sense heritability and genetic advance:

Means, phenotypic and genotypic coefficient of variability (P.C.V. and G.C.V.), heritability (broad sense) and expected genetic advance for all studied characters are given in (Table 3). The two estimates of phenotypic and genotypic coefficient of variation appeared to be high for all studied characters except plant height which showed the lowest estimate of (P.C.V.) and (G.C.V.); 7.37% and 5.42%, respectively. A wide range of phenotypic variation was noticed in characters as plant height and number of primary branches, whereas, characters like number of days to flowering, seed yield/plant and seed yield/plot showed comparatively lower range of phenotypic variation. The genotypic coefficient of variation ranged between 5.42 to 15.91%. The relatively high estimates for seed yield characters indicated that these characters might be more genotypically predominate and it would be possible to achieve further improvement in them. Such variation was also reported for seed yield by Yadav and Yadav (1983) and Priya and Singh (1983).

Table (3): Means, phenotypic and genotypic coefficient of variations (P.C.V. and G.C.V.), heritability estimates and genetic advance for the studied characters.

Characters	Mean	σ^2 ph	σ^2 g	P.C.V. %	G.C.V. %	h^2	Genetic advance G.A.	R% genetic adv. %
No. of days to flowering	67.80	134.42	116.48	17.09	15.91	86.66	22.23	32.77
Plant height	128.71	90.12	48.71	7.37	5.42	54.05	13.12	10.19
No. of primary branches	6.63	0.91	0.18	14.39	6.39	19.78	0.87	13.14
Seed yield per plant, gm.	17.67	12.94	5.80	20.35	13.62	44.82	4.96	28.05
Seed yield per plot, kg.	0.899	0.021	0.016	16.26	14.14	76.19	0.26	28.98

Heritability estimates for number of days to flowering, plant height and seed yield/plot were high, whereas these estimates were low for number of primary branches and seed yield/plant. Burton (1952) suggested that genotypic coefficients of variability, together with heritability estimates, would give a clear picture about the extent of advance to be expected from selection. Therefore, the expected gain from selection (Δg%) would be a better indicator for selection response.

In the present study high heritability was associated with high genetic gain for number of days to flowering and seed yield/plot indicating that the additive gene effect is important in determining these characters. This showed that phenotypic selections may be useful for improving these characters. While the other characters showed low heritability estimates with low genetic gain indicating greater influence of environment and non-additive gene action on the genetic expression of these characters.

REFERENCES

Badwal, S.S.; P.K. Gupta and K.S. Labana (1983). Stability of the crosses in relation to the parental genotypes in Indian mustard. 6th International Rapeseed Congress, Paris, France, 17-19 May.

Burton, G.W. (1952). Quantitative inheritance in grasses. Proc. Sixth Inter. Grassland Cong. 1: 277-283.

Cochran, W.C. and G.M. Cox (1957). Experimental designs. John Wiley and Son, Inc. New York.

Downy, R.K.; G. Robbelen and A. Ashri (1989). Oil crops of the world. Chapter 16, 339. McGraw Hill, 11 West, 19th St. New York.

El-Ahmer, B.A. (1989). Rapeseed in Egypt. Oil Crops Proceeding of the Third Meeding, Pantnagar and Hyderabad, India, 4-17 Jan. 1989.

El-Ahmer, B.A.; K.M. Hammad and M.E. Abou-Ghazala (1994). Evaluation and genetic estimation of some promising strains of mustard (*Brassica juncea* L.) in the north part of Egypt. J. Agric. Sci. Mansoura Univ. 19(3): 855-862, 1994.

Fehr, M.R. (1987). Principals of cultivar development, Vol. 1. Theory and Technique, Chapter 18, Machillan Pub. Company, New York.

Huehn, M. and J. Léon (1983). Some results on yield stability of winter-rape. 6th International Rapeseed Congress, Paris, France, 17-19 May.

Johnson, M.W.; H.F. Robinson and R.E. Comtock (1955). Estimates of genetic and environmental variability in soybean. Agron. J. 47: 314-318.

Priya, R.K. and N.P. Singh (1983). Evaluation of stability and adaptability components in Brassica breeding programme. 6th International Rape Congress, Paris, France, 17-19 May.

Ram, D. and T.P. Yadava (1992). Gene effects for yield and yield attributes in (*Brassica juncea* L.) under two environments. Oil Crops Newsletter, IDRC of Canada, No. 9 June 1992.

Rasmusson, D.C. and R.L. Glass (1967). Estimates of genetic and environmental variability in barley. Crop Sci. 7: 185-188.

Steel, R.G.D. and J.H. Torrie (1980). Principles and procedures of statistics Abrometrical approach 2nd McGraw Hill Inc. New York.

Thakur, H.L.; O.P. Sood; N.R. Kalia and V. Kalia (1992). Adaptability and phenotypic stability of improved mustard (*Brassica juncea* L.) varieties. Oil Crops Newsletter, IDRC of Canada, No. 9 June 1992.

Waller, R.A. and D.B. Duncan (1969). A bays rule for the symmetric multiple comparison problem. J. Am. Stat. Assoc.: 1485-1503.

Yadav, C.K. and T.P. Yadav (1983). Genetic analysis for yield and its component in Indian mustard (*Brassica juncea* L.) 6th International Rapeseed Congress, Paris, France 17-19 May.

دراسات على الاختلافات والتقديرات الوراثية لبعض سلالات الريب (*Brassica campestris* L.)

محمد السيد أبوغزاله
قسم بحوث المحاصيل الزيتية ـ معهد بحوث المحاصيل الحقلية ـ مركز البحوث الزراعية

تم تنفيذ هذا البحث فى محطتى سخا والنوبارية خلال موسمى النمو 98/97 ، 1999/1998م ويهدف إلى دراسة بعض التقديرات الوراثية والتقييم لعدد 9 سلالات من الريب (*Brassica campestris* L.).

وأوضحت النتائج أن الإختلافات الصنفية معنوية وأظهر كلا من الصنفين م 330 ، م 185 تفوقا فى محصول النبات وكذلك أظهر تحليل التباينات المشترك أن تفاعل الاصناف مع السنين كان معنويا لكل الصفات المدروسة ونفس الاتجاه تم ملاحظته لتفاعل الاصناف مع المواقع فيما عدا صفة المحصول/القطعة.

وأظهرت قيم المكافئ الوراثى (بمعناه الواسع) والتحسين الوراثى مدى واسع للصفات التى تم دراستها وأتضح من النتائج أن قيم المكافئ الوراثى لصفات عدد الأيام للتزهير ومحصول القطعة كانت مرتفعة مما يدل على أن جزء كبير من الاختلافات بين الاصناف يرجع إلى الفروق الوراثية ، بينما أظهرت باقى الصفات قيما متوسطة ومنخفضة.

والقيم العالية للمكافئ الوراثى والتحسين الوراثى لبعض الصفات يجعل من الممكن الاعتماد على التراكيب الوراثية للمحصول العالى والاستفادة منها فى برامج الانتخاب والتربية لتحسين صفة المحصول.