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THE PERFORMANCES OF SOME LOCAL VARIETIES OF PRICKLY OIL LETTUCE FOR OIL CONTENT AND IMPORTANT TRAITS

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ABSTRACT

Twenty four prickly lettuce genotypes were studies for phenotypic and genotypic variability, broad sense heritability (h^2_b), phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV%), genetic advance (GA%) of yield and yield components, selection index (SI), phenotypic and genotypic correlation and path coefficient. Significant variations were observed between genotypes for most studied traits during the two seasons (2003/2004 and 2004/2005).The highest genotypic and phonotypic variations were observed for oil yield, seed yield and number of branches/plant, respectively. All the traits showed high heritability values with high genetic advance except for number of branches/plant in both seasons.

Selection index (SI) was estimated for all genotypes of prickly lettuce. Genotypes number : 20, 8, 1 and 2 are considered to be promising for oil yield and oil content. Path coefficient analysis revealed the importance of seed yield per plant and oil content of all genotypes in both seasons. In general, results of genetic parameters (P.C.V, G.C.V. h^2_b%, GA%, and SI and path coefficient analysis) showed the importance of all or most studied traits especially seed yield/plant, oil content % and oil yield/plant as selection criteria in prickly c.: lettuce crop.

Keywords : Varieties, heritability, PCV, GCV, genetic advance, path coefficient, prickly oil lettuce .

INTRODUCTION

(*Lactuca scariola* L.) Is known as prickly oil lettuce, Khass Azzait or wild lettuce. Prickly lettuce is native to Mediterranean region, and belongs to family Astraceae, Prince and Carter (1985). The plant is an erect annual or biennial herb. The seeds contain edible oil, Tanaka (1976). It has been cultivated for oil in Egypt since ancient times. Medicinally, the plants used as antipyretic, digestive, diuretic and hypotonic. It is also used in treatment of cough, swollen liver and chronic cataract, Launert (1981), Lust, (1983) and Chopra *et al.,* (1986). Development of oil seed cultivation has an important role in provide of requisite edible oils. Limited studies and few breeding programs have been done on breeding of genotypes of prickly oil lettuce. It also lacks research efforts for improvement of this plant in Egypt, Rabie (1971).

Ehdai and Noormohammadi (1984) evaluated yield and it's components in two safflower genotypes and found significant positive correlation between seed yield and seed oil percent. Genetic improvement for contributing traits of prickly lettuce oil could be achieved through the understanding of the nature and amount of variability present within the genotypes and the extent to which the desirable trait are heritable. Ram *et al.,* (2005) studied variability pattern and correlation studies in *Silybum marianun* at 15 accessions, in 10 characters, found that seed yield and number of capsules/plant had highest estimates of genotypic variation, heritability and genetic advance and suggested the importance of direct selection for improving this crop.

The genetic coefficient of variation give a clear idea about the extent of genetic variability and heritability of the traits under selection. It is also important from the point of view of fixing desirable types, Makne *et al.* (1979) and Eslam (2004).

The genotypic and phenotypic correlation coefficients measure the closeness degree of the linear relationship between each pairs of traits, Green (1980) and Punia and Gill (1994). Heritability (h^2_b), is an approximate measure of the expression of a trait, Deokar and Patil (1978). Path coefficient analysis is a statistical technique of partitioning the correlation coefficients into its direct and indirect effects, so that the contribution of each trait to yield could be estimated, Tahir *et al.*, (2002).

In this study, the components of phenotypic variation, heritability, genetic advance, the correlations among different characters at genotypic and phenotypic levels and their direct and indirect effects on oil yield were studied in prickly oil lettuce crop.

MATERIALS AND METHODS

A field trials were conducted during (2003/2004 and 2004/2005) growing seasons at the Experimental Station of the National Research Center at Shalakan, Qalubia, Governorate, Egypt. The nursery land was well prepared. Seeds of 24 prickly oil lettuce genotypes, which mainly collected from Upper Egypt populations cultivated of a local varieties, were sown in the nursery in November 18 and November, 22 in the 2003/2004 and 2004/2005 growing seasons, respectively. The seedlings were transplanted when they were forty days old. Plants were harvested in June 14^{th} in both first and second seasons. Recommended agronomic practices were adopted.

Oil content of prickly lettuce oil was extracted by using soxhelt apparatus from air dried seeds samples. Oil seed percentages were determined according to A.O.C.S. (1982). Statistical analyses of data the were made at harvest on : plant height, number of branches/plant, seed yield/plant, oil percentage and oil yield/plant. The experiments of both seasons were lauyed according to a randomized complete blocks design of three replications. Data were recorded on the ten selected plants in each replication for the five traits. Data was then subjected to different statistical analyses using the standard method persented by Steel and Torrie (1980).

The genetic components of variance were calculated as described by Johnson *et al.* (1955). Genotypic and phenotypic coefficient of variation, heritability in broad sense and genetic advance were estimated according to Lush (1949), Burton (1952), and Hanson (1961). The genotypic and phenotypic correlation coefficients and path coefficients were estimated as indicated by Miller *et al.* (1958) and Dewey and Lu (1959).

RESULTS AND DISCUSSION

1- Analysis of variance and mean performance estimates

The analysis of variance presented in Table (1) indicated the persence of significant differences between the genotypes for all traits in both seasons. The mean performances of genotypes in first and second seasons are presented in Table (2).

Table 1: Mean squares of the five characters studied in two seasons I, II (2003/2004) and (2004/2005) for twenty four genotypes of prickly oil lettuce.

Source of variation	d.f.	Plant height (cm)		Number of branches/plant		Seed yield/ plant (gm)		Oil content (%)		Oil yield/ plant	
		I	II	I	II	I	II	I	II	I	II
Rep.	2	11.722	38.84	1.514	0.597	2.224	2.651	2.081	1.211	0.288	0.671
Genotypes	23	141.74**	127.77**	6.34**	9.53**	15.96**	17.71**	60.11**	40.81**	1.62**	1.67**
Error	46	11.79	15.08	2.56	3.00	0.189	0.564	1.325	2.011	0.023	0.062

** = significant at 0.01 level of probability

Table 2: Mean performance of five characters in two seasons (2003/2004) and (2004/2005) of twenty four genotypes of prickly oil lettuce.

Genotypes Code No.	Characters									
	Plant height (cm)		Number of branches/plant		Seed yield/ plant (gm)		Oil content (%)		Oil yield/ plant (gm)	
	Season		Season		Season		Season		Season	
	I	II	I	II	I	II	I	II	I	II
1	107.00	113.33	7.33	9.00	11.87	12.00	25.33	27.33	3.01	3.40
2	108.67	116.00	7.00	7.00	5.50	7.40	31.13	31.57	1.72	2.33
3	104.67	113.67	9.00	11.00	5.30	6.33	29.67	27.23	1.57	1.93
4	107.00	112.33	8.00	10.00	5.70	7.33	29.50	31.17	1.68	2.28
5	87.00	95.00	8.00	12.00	9.20	11.60	31.43	33.43	2.89	3.87
6	95.00	109.00	8.67	10.33	8.63	11.50	26.83	31.13	2.31	3.58
7	104.33	107.33	9.00	10.00	6.00	9.33	30.47	32.67	1.82	3.05
8	112.33	115.00	12.00	13.33	8.83	10.13	29.17	31.83	2.57	3.23
9	90.67	98.33	9.67	11.67	6.27	8.73	24.67	26.67	1.54	2.33
10	95.33	98.00	8.33	10.67	7.67	10.83	29.50	29.80	2.26	3.23
11	101.00	106.00	10.67	14.33	6.10	9.50	26.77	31.00	1.63	2.95
12	91.00	96.33	11.00	12.00	8.57	11.47	25.80	28.47	2.21	3.26
13	101.00	101.00	7.33	8.67	8.27	11.27	17.67	18.33	1.47	2.06
14	94.67	97.67	7.67	8.67	7.33	10.73	24.83	27.63	1.82	2.97
15	107.33	108.67	7.33	8.33	5.53	6.57	28.33	30.33	1.57	1.99
16	95.67	100.00	8.67	9.66	12.97	14.10	31.00	31.50	4.02	4.41
17	103.00	105.00	9.33	11.00	17.97	10.87	21.67	28.67	1.72	2.78
18	98.00	101.67	6.33	7.67	10.57	12.93	25.33	24.00	2.68	2.78
19	96.67	100.33	10.00	11.00	11.30	14.00	17.67	21.67	2.00	3.04
20	110.00	111.33	10.67	12.33	11.13	13.37	31.33	31.40	3.49	4.19
21	98.67	100.67	9.66	10.00	7.93	8.67	30.17	29.57	2.39	2.57
22	96.00	104.33	8.33	10.33	5.53	7.20	25.80	25.33	1.43	1.85
23	103.33	106.00	6.67	8.33	5.60	7.90	18.97	24.10	1.06	1.90
24	91.00	96.67	8.67	9.33	5.83	6.40	18.87	28.33	1.10	1.82
NewLSD. 0.05	5.65	6.39	2.63	2.85	0.715	1.23	1.893	2.33	0.25	0.41
NewLSD 0.01	7.54	8.53	3.51	3.81	0.954	1.65	2.53	3.11	0.34	0.55

It could be observed that the mean performances comparisons for studied traits varied from one genotype to another. Comparisons between genotypes using the New L.S.D. method test indicated the presence at significant differences between genotypes No. 8, 20, and 2 which had the highest values for plant height in both seasons. Genotypes No. 16, 1 and 19 produced the most seed yield and higher amount of oil yield in both season.For number of branches, genotypes No. 8, 20, 11 and 12 had the highest value for this trait in both seasons. These results were in agreement with similar results obtained by Omidi Tabrizi *et al.* (1999) and Ram *et al.* (2005).

2- Genetic parameters

Mean, range, coefficient of variation, heritability and genetic advance are presented in Table (3). It could be observed that there is a limited genotypic variation between the genotypes studied for plant height, seed yield and oil content in the first season. However, the rest of traits in both seasons exhibited a good amount of genotypic variation. Many workers also have reported moderate to a high genetic coefficient of variation for different traits in safflower, Thombre and Joshi, (1977), Deoker *et al.*, (1985) and Narkhede *et al.* (1985), indicated that P.C.V. was greater than G.C.V. for all traits studied, the difference between genotypic and phenotypic variability for all ctraits which was small except for number of branches in both seasons. This indicated that these traits were less influenced by environment. Oil yield and seed weight showed highest genotypic and phenotypic variance in both seasonsas persented in Table (3). The variation between genotypic and phenotypic variance and coefficient of variation were high indicating large environment effect, Patil (1997). Coefficients of genotypic and phenotypic variation suggest that there is a good chance for oil yield/ plant, seed yield /plant and oil content in yield improvement crop through selection.

These findings are in agreement with other reported by Kumar (2000) and Reddy *et al.*, (2003). Except number of branches, heritability estimates were very high for almost all traits studied in both seasons. Johnson *et al.* (1955) suggested that traits with high heritability coupled with a high expected genetic advance would respond to selection. In such cases, additive genes may play an important role in selection, Panse (1957). In the recent investigations, other authors reported the presence a high heritability for seed yield and its attributes such as Patil *et al.* (2002) and Eslam (2004). Broad sense heritability values were high for seed yield/plant, oil yield/plant and oil content in both seasons. The other characters in both season showed moderate to low values, Table (3).

It was interesting notice that high expected genetic advance was high for plant height, oil content and seed yield /plant in both seasons and coupled with high heritability. High heritability with high genetic advance were exhibited as shown in Table (3), reflecting that the traits could be further improved through individual plant selection.

Table 3: Genetic parameters estimates of yield and yield components of 24 genotypes of prickly oil lettuce in (I) first and (II) second season.

Characters	Season	Range	Mean	Phenotypic variation (P.V.C.)	Genotypic variation (G.C.V.)	Heritability (h^2_b)	Genetic advance GA %	GA of Mean %
Plant height (cm)	I	87.00-112.33	99.97	7.43	6.58	0.786	16.06	16.08
	II	95.00-116.00	104.73	6.93	5.85	0.714	13.96	13.33
Number of branches/plant	I	6.33-12.00	8.72	22.41	12.87	0.330	1.53	17.55
	II	7.00-14.33	10.21	22.27	14.43	0.420	2.36	23.11
Seed yield(g/plant)	I	5.33-12.97	7.67	30.41	29.87	0.965	6.50	84.74
	II	6.33-14.10	10.00	25.06	23.89	0.910	6.49	64.90
Oil content (%)	I	17.66-34.43	26.33	17.37	16.81	0.937	12.28	46.64
	II	21.67-33.43	28.46	13.58	12.63	0.865	9.41	33.06
Oil yield (g/plant)	I	1.10-4.02	2.08	35.87	35.33	0.958	2.06	99.03
	II	1.82-4.41	2.82	27.39	25.94	0.896	1.96	69.50

3- Correlation and Path Coefficient

Phenotypic and genotypic correlations were estimated on genotypes of five traits in both seasons between all possible pairs of studied characters, Table (4).

For most traits, genotypic correlation coefficient was higher than phenotypic correlation coefficient. At the phenotypic level, the data showed that all characters except seed yield/plant with plant height were positively correlated with oil yield in the first season. Oil yield with plant height, oil content with seed yield/plant and seed yield/plant with plant height showed a negative correlation in the second season. Oil yield showed strong positive correlation with seed yield/plant and oil content in both seasons indicating that, selection for these traits would lead to an improvement in oil yield with seed yield/plant and with oil content and oil yield with number of branches, seed yield /plant and oil content in the first and second season respectively. Genotypic correlation was positive and significant in case of oil yield with each of seed weight and oil content in both seasons. However, other traits showed non-significant associations at phenotypic and genotypic correlation or negative associations. Similar results were also observed by Caylak and Emiregh, (1984), Tahir *et al.* (2002) and Sarang *et al.* (2004).

Table 4: Phenotypic (above diagonal) genotypic (below diagonal) correlation coefficients among all traits of prickly oil lettuce in the two seasons.

Traits	Plant height cm) X_1	Number of branches X_2	Seed weight (g/plant) X_3	Oil content (%) X_4	Oil yield g/plant) X_5
First season (2004/2005)					
X_1		0.010	-0.065	0.217	0.028
X_2	0.055		0.118	0.127	0.160
X_3	-0.088	0.167		0.025	0.855**
X_4	0.238	0.193	0.023		0.519**
X_5	0.016	0.232	0.857**	0.514**	
Second season (2004/2005)					
X_1		0.040	-0.245	0.240	-0.069
X_2	-0.128		0.137	0.291	0.321
X_3	-0.290	0.222		-0.0101	0.802**
X_4	0.265	0.361*	-0.110		0.445**
X_5	-0.107	0.439*	0.817**	0.474**	

*,** significant at 0.05 and 0.01 levels of probability, respectively.

Association of various traits with oil yield was partitioned into direct and indirect effects, Table (5) as suggested by Dewey and Lu (1959) and Singh and Chandhry (1979). Seed yield had maximum direct effect on oil yield followed by oil content in both seasons. Oil yield for each of the two seasons, the direct effect for plant height was negative and low than direct effect for the other traits with the exception of path coefficient values of seed yield/plant and oil content in both seasons. Besides, number of branches in the second season only.

In both seasons, the indirect effect of plant height on oil yield had positive relationship between plant height and number of branches, oil content and oil yield, respectively, Table (5).

The direct effects of number of branches/plant on oil yield were all negative and of less importance, whereas, in simple simulation study, this trait was positive associated with seed yield/plant and oil content.

The indirect effect of number of branches on oil yield through its association with seed weight and oil content was positive with values of (0.0991 and 0.116) and (0.64 and 0.149) in both seasons. The indirect effect with the other traits was in consistent for first and second seasons. This could be partially attributed to the variation in precipitation during the growing season. Relationships between Yield components in prickly oil lettuce were characterized by strong environmental effects. These results are in agreement with Green (1980), Marinkovic (1992), Punia and Gill (1994) and Ozer and oral (1999).

Table 5: Path coefficient values estimated for oil yield and the other four traits in two seasons of prickly oil lettuce genotypes.

Pathway of association	Values estimated in	
	1^{st} season	2^{nd} season
Oil yield vs. plant height		
Direct effect	-0.027	0.014
Indirect effect via (X_2)	0.0001	0.002
Indirect effect via (X_3)	-0.055	-0.208
Indirect effect via (X_4)	0.110	0.123
Correlation (r_{15})	0.028	-0.069
Oil yield vs. number of branches		
Direct effect	-0.033	0.055
Indirect effect via (X_1)	-0.033	0.001
Indirect effect via (X_3)	0.099	0.116
Indirect effect via (X_4)	0.064	0.149
Correlation (r_{25})	0.160	0.321*
Oil yield vs. seed weight		
Direct effect	0.841	0.850
Indirect effect via (X_1)	0.002	-0.003
Indirect effect via (X_2)	-0.001	0.007
Indirect effect via (X_4)	0.093	-0.052
Correlation (r_{35})	0.855**	0.802**
Oil yield vs. oil content		
Direct effect	0.505	0.511
Indirect effect via (X_1)	-0.006	0.003
Indirect effect via (X_2)	-0.001	0.016
Indirect effect via (X_3)	0.021	-0.086
Correlation (r_{45})	0.519**	0.445**

Positive direct effect of seed yield on oil yield on both seasons was observed. Path coefficient analysis revealed that the indirect effect of seed yield/plant and oil content were negligible and inconsistent in both season. Seed weight was positively correlated with oil content and plant height in first season only in the indirect effect.

The direct effect of plant height and number of branches were negative in the first season, but not in the second season. Correlation study showed that the associations between seed weigh and oil yield showed positive and significant consistent trend. Similarly, path analysis also indicated that this yield component had positively associated with oil content and number of branches in first and second seasons. Based on these results, plant height and number of branches/plant would be effective as selection criterion as seed yield/plant and oil content. The difference in results in both seasons may be attributed to the difference in genetic material and environmental condition of the experiment (Raddy *et al.* 1992, Khan *et al.* 1998 and Malik *et al.* 2000 and Omidi Tabrizi, 2002.)

4- Selection index and promising genotypes

A cursory look at the promising genotypes of prickly lettuce ,Table (6) showed that the genotype No. 20 was the highest oil yield (4.19) in both seasons although the seed yield were low (11.13 and 10.06) in first and second season, respectively. Genotype No. 16 followed by 6, 8 and 1 recorded high oil yield but they were low in other traits. For oil content, genotype No 8, 20 and 2 showed the highest values of seed yield. Therefore they were judged to be promising these genotypes could be used in breeding programs for improvement of different traits in prickly lettuce oil. These results are in agreement with Omidi Tabrizi, *et al* (1999) and Patil *et al.* (2002).

Table 6: The best five genotypes over the five studied traits according to selection index in the two seasons I, II, of prickly oil lettuce genotypes.

Season	Genotypes Code No.	Oil yield (X_5)	Plant height (X_1)	No. of branches/ plant (X_2)	Seed yield (g/plant) (X_3)	Oil % content (X_4)
I	20	3.49	110.0	10.67	11.13	31.33
	8	2.57	112.33	12.00	8.83	29.17
	1	3.01	107.00	7.33	11.87	25.33
	2	1.72	108.67	7.00	5.50	31.13
	16	4.02	95.67	8.67	12.97	31.00
Mean		**2.96**	**106.73**	**9.13**	**10.06**	**29.29**
II	20	4.19	111.33	12.33	13.37	31.40
	8	3.23	115.00	13.33	10.13	31.83
	1	3.58	109.00	10.33	11.50	131.13
	2	2.33	116.00	7.00	7.40	31.57
	16	3.40	113.33	9.00	12.00	27.33
Mean		**3.35**	**112.87**	**10.90**	**10.88**	**30.65**

In conclusion, the present study gave evidence on the genetic differences between selected genotypes. All genetic parameters related to selection revealed that a parameter which had high range of genetic variability, high heritability, high genetic advance, highest degree of positive and significant correction coefficient and highest direct effect on oil yield would be very effective and excellent tool for improving oil yield potential. It is concluded that, these genotypes are recommended to be used in future to develop new stable prickly oil lettuce cultivars with economic values and gave a useful picture of the relationship between oil yield and yield component. It is also allows to have a better understanding of yield component compensation and provide additional information on component interrelationships.

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المستوي الإنتاجي لبعض الأصناف المحلية لخس الزيت لصفة نسبة الزيت وبعض الصفات الهامة

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أجرى هذا البحث خلال الموسمين الشتويين(٢٠٠٣/٢٠٠٤-٢٠٠٤/٢٠٠٥) على ٢٤ صنف محلي من خس الزيت لدراسة التباين الوراثي والمظهرى والمكافئ الوراثي والمكسب الوراثى المتوقع ودليل الانتخاب ومعامل المرور بمحطة تجارب المركز القومى للبحوث – شلقان – قليوبية.

وقد أوضحت الدراسة النتائج التالية:

١- أظهر تحليل التباين وجود اختلافات عالية المعنوية بين االأصناف المدروسة فى الموسمين فى جميع الصفات تحت الدراسة.

٢- كان الفرق بين معامل التباين المظهرى ومعامل التباين الوراثى قليلا لصفات طول النبات ومحصول البذور/للنبات ونسبة الزيت ومحصول الزيت في كل من الموسمين تحت الدراسة مما يعكس أهمية التباين الوراثى لتلك الصفات.

٣- كانت قيم المكافئ الوراثى بمعناه الواسع والمكسب الوراثى المتوقع عالية لصفات محصول الزيت/النبات ونسبة الزيت% ووزن البذور/النبات – وطول النبات في كل من الموسم الأول والثانى.

٤- اظهر تحليل التلازم بين الصفات ومعامل المرور أهمية مساهمة صفتى وزن البذور/النبات والنسبة المئوية للزيت للتأثيرين المباشر وغير المباشر فى الموسمين تحت المستوين المظهرى والوراثى.

٥- أظهر دليل الانتخاب من خلال دراسة ٢٤ صنف محلي من خس الزيت لجميع الصفات المدروسة إمكانية الحصول على بعض التراكيب الوراثية المتميزة والمبشرة فى محصول الزيت ومحصول البذور ونسبة الزيت والتى يمكن استخدامها فى برامج التربية والانتخاب فيها للحصول على تراكيب وراثية متميزة فى صفتى نسبة الزيت ومحصول البذور.