

Preliminary studies on the performance of some cultivars of mustard under arid climate in Kuwait

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ABSTRACT

Eight cultivars of *Brassica campestris*, four cultivars of *B. juncea*, and wild *B. tournefortii* were used to study their performance under the climatic condition of Kuwait. Ten characteristics were investigated. Four cultivars of *B. campestris*, namely Toria-app-8-4, Toria-17, Toria-20, and Toria-TP, were found to perform significantly well and produced heavier seeds, higher seed yield per plant, and higher oil content in the seed.

INTRODUCTION

The state of Kuwait is situated between latitudes 28° 30' and 30° 05' N, and between longitudes 46° 33' and 48° 30' E. The topography of Kuwait was described by Milton (1967) and Fuchs *et al.* (1968), and an account of the soil, temperature, rainfall, and relative humidity was given by Halwagy & Halwagy (1974). The general topography is flat to gently rolling open desert with very few minor elevations, wadis, depressions, sandy dunes, and coastal salt marshes. The soil is mostly calciferous and/or gypsiferous sandy to sandy loam desert soil. The climate is arid with hot dry summer and cool rainy winter. Average temperature during summer season ranges between 25 and 45°C and during winter between 5 and 30°C. Rainfall, though, shows great fluctuations in time and space, varying between 50 and 200 mm. Relative humidity is high in winter (30–95%) and low in summer (15–50%). Fog and mist occur frequently in winter.

Brassica tournefortii Gouan, a species of mustard family (Cruciferae), grows very luxuriously as a wild annual in the desert of Kuwait. It was, therefore, proposed that cultivars of edible oil-yielding species, such as *B. campestris* L. and *B. juncea* L., might be introduced and acclimatised or suitable cultivar(s) might be developed by effective selection following hybridization which would be adapted to the arid climate of Kuwait and would yield reasonably sufficient amounts of seed and seed-oil for commercial extraction.

The objective of the present investigation was to study the performance of a number of cultivars of *B. campestris* L. and *B. juncea* L. under local growing conditions.

MATERIALS AND METHODS

Eight cultivars of *B. campestris* L., namely Toria-app-8-4, Toria-7, Toria-17, Toria-20,

Table 1. Mean character measurements of the eight cultivars of *B. campestris*, four cultivars of *B. juncea*, and *B. tournefortii*

Species/cultivar	Year	Seed germination (%)	Plant height (cm)	Days-to-flowering	Days-to-maturity	Fruit length (cm)	No. fruits/plant	No. seeds/fruit	Seed weight/fruit (mg)	Seed Yield/plant (g)	Oil content (%)	
<i>B. campestris</i>												
Torja-app-8-4	1977	97.33 ± 0.33	65.25 ± 3.10	54.34 ± 2.22	72.25 ± 3.04	5.07 ± 0.03	180.24 ± 5.25	30.54 ± 2.26	7.36 ± 0.21	12.52 ± 1.36	33.75 ± 1.77	
	1978	97.00 ± 1.00	68.30 ± 2.45	55.76 ± 1.53	70.11 ± 2.63	4.92 ± 0.51	176.65 ± 4.36	32.00 ± 1.53	7.02 ± 0.56	11.65 ± 2.03	32.20 ± 2.15	
	<i>t</i>	0.56	2.44*	1.67	1.69	0.79	1.66	1.70	1.80	1.13	1.76	
Torja-7	1977	97.00 ± 1.00	65.52 ± 2.16	52.15 ± 2.07	71.20 ± 3.55	4.96 ± 0.25	110.63 ± 3.94	31.93 ± 3.03	5.33 ± 0.50	4.81 ± 1.20	25.20 ± 2.01	
	1978	97.67 ± 0.33	66.03 ± 2.51	53.82 ± 2.69	72.52 ± 3.00	4.74 ± 0.34	113.70 ± 5.01	33.10 ± 2.68	5.65 ± 0.71	6.23 ± 1.65	26.00 ± 1.55	
	<i>t</i>	1.10	0.49	1.56	0.90	1.65	1.52	0.91	1.19	2.18*	1.00	
Torja-17	1977	97.67 ± 2.33	64.34 ± 4.00	53.00 ± 1.59	72.11 ± 4.08	4.71 ± 0.11	154.15 ± 4.67	30.20 ± 2.87	7.11 ± 0.36	10.32 ± 1.28	31.20 ± 2.33	
	1978	98.33 ± 2.33	61.78 ± 1.56	54.21 ± 2.10	70.56 ± 2.91	4.56 ± 0.27	150.67 ± 6.28	32.16 ± 3.00	6.75 ± 0.68	11.00 ± 1.54	30.00 ± 1.61	
	<i>t</i>	0.35	0.60	1.46	0.98	1.63	1.40	1.50	1.50	1.08	1.33	
Torja-20	1977	96.67 ± 2.33	60.72 ± 4.12	52.58 ± 3.00	73.25 ± 3.97	4.66 ± 0.25	150.53 ± 5.00	32.00 ± 3.88	7.14 ± 0.40	10.00 ± 1.80	30.55 ± 1.96	
	1978	96.00 ± 1.00	62.88 ± 1.96	53.25 ± 1.26	72.00 ± 3.06	4.80 ± 0.21	145.75 ± 5.63	31.10 ± 1.35	6.83 ± 0.61	10.66 ± 1.23	31.10 ± 1.88	
	<i>t</i>	0.46	1.50	0.65	0.79	1.36	2.01	0.69	1.35	0.96	1.69	
Torja-BP	1977	98.00 ± 3.00	62.36 ± 3.69	54.50 ± 2.87	72.60 ± 4.00	4.87 ± 0.29	137.02 ± 6.23	36.15 ± 4.00	6.17 ± 0.67	7.90 ± 1.07	28.87 ± 1.81	
	1978	98.00 ± 1.00	64.54 ± 2.03	52.81 ± 2.22	70.24 ± 2.67	4.65 ± 0.24	140.15 ± 4.33	34.23 ± 2.93	6.50 ± 0.33	8.20 ± 2.21	27.50 ± 2.00	
	<i>t</i>	—	1.65	1.47	1.55	1.83	1.30	1.22	1.38	0.38	1.61	
Torja-TP	1977	96.67 ± 2.33	64.34 ± 1.90	53.80 ± 0.98	73.53 ± 2.87	4.95 ± 0.36	135.74 ± 4.11	30.87 ± 4.08	7.73 ± 0.54	9.82 ± 1.63	32.54 ± 2.06	
	1978	97.00 ± 1.00	62.78 ± 2.10	54.71 ± 1.37	71.68 ± 2.91	4.90 ± 0.17	138.00 ± 3.76	31.00 ± 1.86	7.30 ± 0.47	8.25 ± 2.10	30.85 ± 1.65	
	<i>t</i>	0.22	1.58	1.72	1.43	0.40	1.28	0.09	1.87	1.87	2.03	

Assam Local	1977	97.00 ± 3.00	61.36 ± 2.32	53.25 ± 3.10	71.60 ± 3.73	4.82 ± 0.81	142.60 ± 5.10	33.31 ± 2.45	6.78 ± 0.13	8.94 ± 0.85	30.40 ± 1.98
	1978	98.00 ± 3.00	60.05 ± 2.45	51.64 ± 2.33	73.05 ± 3.25	4.56 ± 0.35	140.05 ± 4.60	31.20 ± 2.14	6.53 ± 0.52	9.23 ± 1.36	29.10 ± 2.22
	<i>t</i>	0.41	1.22	1.31	0.93	0.93	1.17	2.05	1.47	0.57	1.38
B.S.H.1	1977	96.67 ± 2.33	62.25 ± 4.10	51.38 ± 1.25	73.10 ± 3.05	4.35 ± 0.44	148.00 ± 2.54	34.00 ± 0.90	6.60 ± 0.37	9.24 ± 1.30	29.00 ± 2.00
	1978	98.00 ± 1.00	60.10 ± 2.36	52.80 ± 2.54	72.44 ± 2.65	4.61 ± 0.38	145.16 ± 4.15	33.25 ± 2.10	6.85 ± 0.41	9.00 ± 1.65	28.10 ± 1.36
	<i>t</i>	0.91	1.44	1.69	0.52	1.41	1.84	1.04	1.47	0.36	1.18
<i>B. juncea</i>											
Rai-5	1977	93.67 ± 4.33	54.56 ± 3.00	45.10 ± 2.87	65.35 ± 2.77	4.10 ± 0.09	80.48 ± 2.36	24.15 ± 1.67	6.48 ± 0.39	4.94 ± 0.56	25.24 ± 1.73
	1978	93.67 ± 2.33	56.05 ± 2.41	46.25 ± 1.92	67.09 ± 3.00	4.25 ± 0.24	82.56 ± 3.81	25.35 ± 2.25	6.05 ± 2.25	5.26 ± 1.45	26.00 ± 1.60
	<i>t</i>	1.09	1.06	1.35	1.88	1.46	1.35	2.00	0.65	1.03
Rai-app-1	1977	94.00 ± 3.00	55.02 ± 2.01	44.40 ± 2.05	67.45 ± 2.58	4.90 ± 0.24	81.10 ± 1.89	25.00 ± 1.89	7.14 ± 0.48	5.00 ± 0.98	26.00 ± 1.80
	1978	95.00 ± 1.00	57.66 ± 2.63	45.88 ± 1.77	66.13 ± 1.66	4.71 ± 0.37	82.50 ± 2.50	26.15 ± 2.03	6.68 ± 0.66	5.52 ± 2.11	25.50 ± 1.55
	<i>t</i>	0.55	2.51*	1.72	1.36	1.36	1.41	1.32	1.77	0.71	0.67
K.B.2	1977	93.33 ± 2.33	54.16 ± 5.00	45.00 ± 1.57	67.00 ± 3.39	4.68 ± 0.33	78.45 ± 3.46	25.31 ± 0.99	6.82 ± 0.40	4.78 ± 0.93	24.80 ± 2.11
	1978	94.67 ± 2.33	56.30 ± 1.82	46.12 ± 2.30	68.10 ± 2.76	4.73 ± 0.20	81.30 ± 4.15	24.00 ± 1.88	6.35 ± 0.71	5.00 ± 1.69	25.00 ± 1.67
	<i>t</i>	0.71	1.27	1.27	0.80	0.41	1.67	1.95	1.81	0.36	0.24
Loha 101	1977	94.00 ± 3.00	53.78 ± 2.54	43.54 ± 1.88	66.50 ± 3.47	4.87 ± 0.18	80.36 ± 5.67	25.40 ± 3.20	6.68 ± 0.39	4.81 ± 1.01	24.75 ± 1.44
	1978	95.00 ± 4.00	55.10 ± 1.37	45.00 ± 2.71	67.30 ± 2.92	4.70 ± 0.30	83.00 ± 4.23	26.11 ± 0.59	6.50 ± 0.25	5.21 ± 1.68	25.10 ± 1.89
	<i>t</i>	0.35	1.45	1.40	0.58	1.54	1.18	1.36	1.20	0.65	0.47
<i>B. tournefortii</i>	1977	98.67 ± 1.33	88.35 ± 5.81	60.00 ± 3.15	80.10 ± 4.80	6.45 ± 0.90	244.25 ± 6.18	20.00 ± 3.15	3.34 ± 0.18	6.50 ± 1.23	10.20 ± 1.50
	1978	97.33 ± 3.00	85.20 ± 3.06	58.14 ± 2.88	78.54 ± 3.68	5.88 ± 0.73	240.00 ± 5.77	22.35 ± 2.45	3.80 ± 0.77	5.76 ± 2.05	12.00 ± 3.10
	<i>t</i>	0.88	1.51	1.38	0.82	1.56	1.59	1.77	1.84	0.97	1.65

*Significant at the 5% level.

Toria-BP, Toria-TP, Assam Local, and B.S.H.1; four cultivars of *B. juncea* L., namely Rai-5, Rai-app-1, K.B.2, and Loha 101; and wild *B. tournefortii* Gouan were used in the present study. The seeds were sown in the field in the Department of Botany and Microbiology, University of Kuwait, in January 1977. The experiment was set up in a randomized block design with three replications. Each replication consisted of an area of 420 × 300 cm. There were 13 rows, one for each cultivar. The space between rows was 30 cm and that between plants within a row was 15 cm. Ten plants were picked up at random for collecting data. Ten characteristics were studied, viz., percentage of seed germination, plant height (in cm), days-to-flowering, days-to-maturity, fruit length (in cm), number of fruits per plant, number of seeds per fruit, seed weight per fruit (in mg), seed yield per plant (in g), and percentage of seed-oil content. Data were recorded on an individual plant basis. Five fruits were picked up randomly from each plant and their average was used to determine fruit length, number of seeds per fruit, and seed weight per fruit.

One hundred seeds of each cultivar and of *B. tournefortii* were germinated in large Petri-dishes with moistened blotting paper at room temperature and the percentage of germination was recorded. Percentage of seed-oil content was estimated following the method suggested by Kartha & Sethi (1956). The experiment was repeated in 1978.

Unpaired *t*-test (Steel & Torrie 1960) was used to compare the data of 1977 and 1978. Duncan's multiple range test (Duncan 1955) was used to detect any significant difference in character performance among the cultivars.

RESULTS

The mean character performances of the eight cultivars of *B. campestris*, four cultivars of *B. juncea*, and *B. tournefortii* with respect to ten characteristics are presented in Table 1. Except for plant height and seed yield per plant, no significant differences were detected between the data of 1977 and 1978 ($P=0.05$). Significant differences were observed only in Toria-app-8-4 and Rai-app-1 for plant height (2.44* and 2.51*, respectively), and in Toria-7 for seed yield per plant (2.18*). A wide range of variation, however, was observed among the cultivars for most characteristics studied in both years.

Duncan's multiple range tests carried out on the data of 1977 and 1978 are shown in Tables 2 and 3, respectively. The analyses of the Tables 2 and 3 are given together. However, each character is considered separately.

Percentage of seed germination. *Brassica tournefortii* and all cultivars of *B. campestris* had relatively higher percentages of seed germination, whereas all the cultivars of *B. juncea* had lower percentages in both years. Toria-20, however, had a relatively lower percentage of seed germination than the rest of the cultivars of *B. campestris*.

Plant height. In both years, *B. tournefortii* was the tallest, while all cultivars of *B. juncea* were the shortest. All the cultivars of *B. campestris* had intermediate height. However, Toria-20, Toria-BP, Assam Local, and B.S.H.1 in 1978 had relatively lower plant heights than the remaining cultivars of *B. campestris*.

Days-to-flowering. The three species were significantly different with respect to days-to-flowering in both years. *Brassica tournefortii* was late, cultivars of *B. campestris*

Table 2. Detection of significant differences in character performance in 1977 among eight cultivars of *B. campestris*, four cultivars of *B. juncea*, and *B. tournefortii*.

Species/cultivar	Seed germination (%)	Plant height (cm)	Days-to-flowering	Days-to-maturity	Fruit length (cm)	No. fruits/plant	No. seeds/fruit	Seed weight/fruit (mg)	Seed yield/plant (g)	Oil content (%)
<i>B. campestris</i>										
Toria-app-8-4	97.33ab*	65.25b	54.34b	72.25b	5.07b	180.24b	30.54b	7.36ab	12.52a	33.75a
Toria-7	97.00b	65.52b	52.15b	71.20b	4.96b	110.63cde	31.93b	5.33d	4.81d	25.20cd
Toria-17	97.67ab	64.34b	53.00b	72.11b	4.71b	154.15bc	30.20abc	7.11abc	10.32ab	31.20ab
Toria-20	96.67b	60.72bc	52.58b	73.25b	4.66b	150.53bc	32.00b	7.14abc	10.00b	30.55abc
Toria-BP	98.00ab	62.36bc	54.50b	72.60b	4.87b	137.02bcd	36.15a	6.17cd	7.90bc	28.87abcd
Toria-TP	96.67b	64.34b	53.80b	73.53b	4.95b	135.74cd	30.87b	7.73a	9.82b	32.54a
Assam Local	97.00b	61.36bc	53.25b	71.60b	4.82b	142.60bcd	33.31ab	6.78abc	8.95b	30.40abcd
B.S.H.1	96.67b	62.25bc	51.38b	73.10b	4.35b	148.00bc	34.00ab	6.60bc	9.24b	29.00abcd
<i>B. juncea</i>										
Rai-5	93.67c	54.56c	45.10c	65.35c	4.10b	80.48e	24.15cd	6.48bc	4.94d	25.24cd
Rai-app-1	94.00c	55.02c	44.40c	67.45c	4.90b	81.10e	25.00c	7.14abc	5.00d	26.00bcd
K.B.2	93.33c	54.16c	45.00c	67.00c	4.68b	78.45e	25.31c	6.82abc	4.78d	24.80d
Loha 101	94.00c	53.78c	43.54c	66.50c	4.87b	80.36e	25.40c	6.68bc	4.81d	24.75d
<i>B. tournefortii</i>	98.67a	88.35a	60.00a	80.10a	6.45a	244.25a	20.00d	3.34d	6.50cd	10.20e

*Means of a character followed by the same letter or letters are not significantly different at the 5% level.

Table 3. Detection of significant differences in character performance in 1978 among eight cultivars of *B. campestris*, four cultivars of *B. juncea*, and *B. tournefortii*

Species/cultivar	Seed germination (%)	Plant height (cm)	Days-to-flowering	Days-to-maturity	Fruit length (cm)	No. fruits/plant	No. seeds/fruit	Seed weight/fruit (mg)	Seed yield/plant (g)	Oil content (%)
<i>B. campestris</i>										
Toria-app-8-4	97.00ab*	68.30b	55.76b	70.11b	4.92ab	176.65b	32.00ab	7.02ab	11.65a	32.20a
Toria-7	97.67a	66.03b	53.82b	72.52b	4.74b	113.70d	33.10a	5.65c	6.23cd	26.00c
Toria-17	98.33a	61.78bc	54.21b	70.56b	4.56b	150.67c	32.16ab	6.75b	11.00a	30.00ab
Toria-20	96.00bc	62.88bc	53.25b	72.00b	4.80ab	145.75c	31.10b	6.83b	10.66a	31.10a
Toria-BP	98.00a	64.54b	52.81b	70.24b	4.65b	140.15c	34.23a	6.50b	8.20b	27.50bc
Toria-TP	97.00ab	62.78bc	54.71b	71.68b	4.90ab	138.00c	31.00b	7.30a	8.25b	30.85a
Assam Local	98.00a	60.05bc	51.64b	73.05b	4.56b	140.05c	31.20b	6.53b	9.23ab	29.10ab
B.S.H.1	98.00a	60.10bc	52.80b	72.44b	4.61b	145.16c	33.25a	6.85b	9.00ab	28.10b
<i>B. juncea</i>										
Rai-5	93.67d	56.05c	46.25c	67.09c	4.25b	82.56e	25.35c	6.05bc	5.26d	26.00c
Rai-app-1	95.00cd	57.66c	45.88c	66.13c	4.71b	82.50e	26.15c	6.68b	5.52d	25.50c
K.B.2	94.67d	56.30c	46.12c	68.10c	4.73b	81.30e	24.00cd	6.35b	5.00d	25.00c
Loha 101	95.00cd	55.10c	45.00c	67.30c	4.70b	83.00e	26.11c	6.50b	5.21d	25.10c
<i>B. tournefortii</i>	97.33ab	85.20a	58.14a	78.54a	5.88a	240.00a	22.35d	3.80d	5.76d	12.00d

*Means of a character followed by the same letter or letters are not significantly different at the 5% level.

were medium, and cultivars of *B. juncea* were early in flowering. The cultivars of *B. campestris* and *B. juncea* were more or less similar within their respective groups.

Days-to-maturity. As in days-to-flowering, the three species were also significantly different with respect to days-to-maturity in both the years. *Brassica tournefortii* was late, cultivars of *B. campestris* were medium, and cultivars of *B. juncea* were early in maturity. The cultivars of *B. campestris* and *B. juncea* were more or less similar within their respective groups.

Fruit length. *Brassica tournefortii* produced significantly longer fruits than cultivars of both *B. campestris* and *B. juncea* in 1977. But in 1978, three cultivars of *B. campestris*, namely Toria-app-8-4, Toria-20, and Toria-TP, produced relatively longer fruits and were more or less similar to *B. tournefortii*.

Number of fruits per plant. *Brassica tournefortii* had the highest number of fruits, whereas cultivars of *B. campestris* had a medium number and cultivars of *B. juncea* had the lowest number of fruits per plant in both years. However, the cultivars of *B. campestris* were highly variable.

Number of seeds per fruit. Toria-BP, Assam Local, and B.S.H.1 in 1977 and Toria-app-8-4, Toria-7, Toria-17, Toria-BP, and B.S.H.1 in 1978 produced the highest number of seeds per fruit, whereas all the cultivars of *B. juncea* produced a lower number of seeds per fruit, and *B. tournefortii* produced the lowest number of seeds per fruit in both years. The remaining cultivars of *B. campestris*, however, had a relatively higher number of seeds per fruit than those of *B. juncea*.

Seed weight per fruit. Seed weight per fruit was more variable in 1977 than in 1978. However, in both years, *B. tournefortii* was the lowest. Toria-app-8-4 and Toria-TP of *B. campestris* were the highest in 1977, whereas Toria-app-8-4, Toria-17, Toria-TP, and Assam Local of *B. campestris* and Rai-app-1 and K.B.2 of *B. juncea* had the highest seed weight per fruit in 1978. The remaining cultivars were more or less intermediate.

Seed yield per plant. Toria-7 of *B. campestris*, all cultivars of *B. juncea* and *B. tournefortii* yielded relatively lower seed yields per plant in both years. Toria-app-8-4 and Toria-17 were the highest yielders in 1977, whereas Toria-app-8-4, Toria-17, Toria-20, Assam Local, and B.S.H.1 were the highest yielders in 1978. It may be noted that in both 1977 and 1978, *B. tournefortii* produced longer fruits and the highest number of fruits per plant, but had lowest number of seeds per fruit and lowest seed weight per fruit, and as a result was one of the lowest yielders of seed per plant.

Percentage of seed-oil content. In both years, except for Toria-7, all cultivars of *B. campestris* had relatively higher percentages of seed-oil, whereas *B. tournefortii* had the lowest. The cultivars of *B. juncea* also had a relatively lower seed-oil content.

DISCUSSION

The cultivars of the variety 'Toria' of species *B. campestris*, popularly known as

'mustard' in Afro-Asian countries and as 'rapeseed' in Western countries, are generally cultivated as the main source of edible oil in many countries. Results obtained in the present investigation suggest that some of the cultivars, especially those of variety Toria, performed significantly well for most of the characteristics studied under the hot, dry, desert climate of Kuwait. Toria-app-8-4, Toria-17, Toria-20, and Toria-TP required medium days-to-flowering and maturity, had medium plant height, fruit length, number of fruits per plant, and number of seeds per fruit, but produced significantly highest seed weight per fruit (heavier seeds), seed yield per plant and oil content in the seed.

Chaudhary (1967) studied correlations among yield components in *B. juncea* and found that yield was highly correlated with number of pods (fruits) per plant and number of seeds per pod. Joarder & Eunus (1969) found a significant correlation between number of fruits per plant and seed yield per plant in *B. campestris*. They also reported highly significant correlations, both phenotypically and genotypically, among seed yield per plant and five yield components. Zuberi & Ahmed (1973) found highly significant and positive correlations between total seed yield and number of fruits per plant, number of seeds per fruit, and fruit length. Number of seeds per fruit was also positively correlated with fruit length. The linear relationships existing among the yield-contributing characteristics indicate the possibility of having a further improvement toward higher yield in this crop.

Brassica tournefortii had longer fruits and a higher number of fruits per plant. A carefully planned breeding programme between this species and promising cultivars, if successful, would be expected to produce a significant improvement in yield.

REFERENCES

- Chaudhary, L.B. 1967. Correlation studies in *Brassica juncea*. Indian J. Genet. **29**: 289-92.
- Duncan, D.B. 1955. Multiple range and multiple F tests. Biometrics **11**: 1-42.
- Fuchs, W., Gattinger, E.T. & Holzer, F.H. 1968. Explanatory text of the synoptic geological map of Kuwait. Geological Survey of Austria, Vienna.
- Halwagy, R. & Halwagy, M. 1974. Ecological studies on the desert of Kuwait. I. The physical environment. J. Univ. Kuwait (Sci.) **1**: 75-86.
- Joarder, O.I. & Eunus, A.M. 1969. Genetic studies of yield and yield components of *Brassica campestris* L. Pak. J. Bot. **1**: 39-46.
- Kartha, A.R.S. & Sethi, A.S. 1956. Rapid estimation of oil content of oilseeds. J. Scient. Ind. Res. **15B**: 102-3.
- Milton, D.I. 1967. Geology of the Arabian Peninsula. Kuwait Geol. Surv. Prof. Paper **560-F**: 1-7.
- Steel, G.D. & Torrie, J.H. 1960. Principles and procedures of statistics. McGraw-Hill, N.Y.
- Zuberi, M.I. & Ahmed, S.U. 1973. Genetic study of yield and some of its components in *Brassica campestris* L. var. 'Toria'. Crop Sci. **13**: 13-15.

(Received 4 June 1978)

دراسات أولية على بعض أنواع نبات الخردل **Mustard**
تحت ظروف الزراعة الصحراوية في الكويت

صادق الدين أحمد
قسم النبات والميكروبيولوجيا بجامعة الكويت

خلاصة

تمت دراسة مقارنة لثنائية أصناف مزروعة من نوع (*Brassica campestris*) وأربعة أصناف مزروعة من نوع (*B. juncea*) والنوع المحلي (*B. tournefortii*) الذي ينمو طبيعيا في صحراء الكويت ، وكانت المقارنة على أساس عشر صفات للنبات . وقد تفوقت أربعة أصناف مزروعة (*Toria-TP, Toria-20, Toria-17, Toria-app-8-4*) من نوع *B. campestris* حيث أعطت محصولا أوفر من البذور بالنسبة للنبات الواحد ، كما كانت البذور أكبر حجما ، ونسبة الزيت فيها أعلى ما يمكن .

