

Some morphological and technological characteristics of sesame (*Sesamum indicum* L.) from Macedonia

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Original scientific paper

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Abstract

In this study, ten breeding lines of sesame (*Sesamum indicum* L.) from Macedonia were evaluated in respect to morphological and technological traits for their utilization in both agricultural applications and food industry. A considerable variation was found among the genotypes for number of capsule per plant, seed yield per plant and seed yield per m². The length of the cotyledons had a negative and considerable correlation with length of vegetation of the examples ($r = -0.625^{**}$). The seed yield per plant had a positive and considerable correlation with number of capsule per plant ($r = 0.949^{*}$). Absolute weight of the seed were positive significant correlation with length of internodes ($r = 0.561^{*}$), while the percentage of the oil in seeds had a negative and considerable correlation with the height of the plants ($r = -0.776^{*}$). Also protein content recorded the highest negative association with absolute weight of the seeds followed by oil content of the seeds ($r = -0.650^{**}$; $r = -0.654^{**}$). The results which we obtain suggest that evaluated breeding lines of sesame could be valuable materials for breeding programs.

Key words: sesame, correlation, capsule, yield, seed, oil content, protein content

Introduction

Sesame (*Sesamum indicum* L.) is one of the most ancient crops (Bedigian & Harlan, 1986). It is grown in tropical and subtropical areas on 6.5 million hectares worldwide, producing more than 3 million tones of seed (Ashri, 1998; FAO, 2005). Sesame seed which is highly nutritive (50% oil and 25% protein), is traditionally used for direct consumption and as a source of oil of excellent quality due to presence of natural antioxidants such as sesamin and sesamol (Brar & Ahuja, 1979). Yield of sesame is generally poor compared with other crops due to the genetic and environmental factors (Ashri, 1998). Thus, most efforts in sesame breeding programs emphasize on improvement of seed yield. The effectiveness of a selection program for improving a quantitative trait such as seed yield and components correlated with the yield is mostly dependent upon the genetic variation of the trait in the germplasm and heritability (Falconer & Mackay, 1996). The objective of this study was to investigate associations among important trait such as number of capsule/plant, yield/plant, yield/m², absolute seed weight and oil and protein content in 10 breeding sesame lines from Macedonia. The results could be helpful to selection of parent for genetic design and will be the basis of future studies.

Material and methods

Ten local populations (IJKMK001, IJKMK002 ...IJKMK010) of sesame were used for this study (table 1). The experiment was carried out during the year 2004 and 2005 at the experimental field on the Institute for Southern Crops in Strumica. The experimental design was randomized blocks in three replications. Each sub-plot was comprised of 10 m² area, with 2.0 m wide and 5.0 m long. In the row planting plots, the rows were established with 0.7 m apart. The populations were sown on May 14, 2004 and on May 17, 2005, using a seed rate of 7.0 kg/ha. Nitrogen – 70 kg/ha and phosphorus – 80 kg/ha, were applied before planting and additional nitrogen dose at 80 kg/ha was applied at the beginning of flowering. During the vegetation the plots were not irrigate, hand-hoe and chemically protected. Harvested was done manually on September 20, 2004

and on September 25, 2005. Length of cotyledons (1), length of internodes (2), plant height (3), vegetation period (4), capsule number per plant (5), length of capsule (6), number of seed per capsule (7), yield per plant (8), yield per m² (9) and absolute weight (10) were recorded on 10 plants randomly chosen in each sub-plot before harvesting (the present data in table 1 are the average values from bought years). The oil content (11) and protein content of seeds (12) were determined by Soxhlet and Kjeldal methods, respectively. Data were analyzed using standard analyses of variance (ANOVA) technique and means correlation coefficient were separated using Least Significant Difference Comparisons.

Results and discussion

Mean of characteristics for 10 local populations of sesame are summarized in Table 1.

Table 1. Mean of some morphological and technological traits of 10 sesame populations

Ordinal number	1	2	3	4	5	6	7	8	9	10	11	12
IJKMK001	10.8	6.3	104.8	132	105	3.0	71	11.0	99.5	3.3	53.5	19.2
IJKMK002	11.2	6.5	108.8	132	135	2.9	63	19.2	153.6	3.5	54.0	18.9
IJKMK003	9.8	5.2	108.2	133	154	3.4	70	25.9	207.3	3.2	53.8	18.4
IJKMK004	9.6	5.5	104.4	132	154	3.0	74	22.7	205	2.9	54.1	18.7
IJKMK005	11.0	5.6	96.0	132	200	2.9	56	29.4	235.8	3.6	54.8	18.6
IJKMK006	9.8	5.5	98.8	132	83	3.0	68	9.2	82.7	3.0	53.9	18.9
IJKMK007	9.4	4.8	108.8	133	118	2.8	68	17.2	189.9	3.0	54.4	19.1
IJKMK008	10.2	5.6	113.0	134	165	2.9	61	22.4	201.6	2.9	53.7	19.2
IJKMK009	11.0	5.0	131.2	132	123	2.9	63	17.8	196.2	2.9	53.0	19.5
IJKMK010	11.6	3.8	116.2	130	149	2.8	62	24.7	246.8	3.7	53.5	19.3

The minimum and maximum plant height were belonged to IJKMK005 (96.0 cm) and IJKMK009 (131.2 cm), respectively. Number of capsule per plant ranged from 83 to 200 with populations IJKMK005 and IJKMK006 ranking the highest and lowest respectively. Number of seed/capsule differed from 56 to 74 and populations IJKMK005 and IJKMK004 had the lowest and highest values. Means of seed yield per plant varied between 9.2 g (IJKMK006) to 29.4 g (IJKMK005). In this manner, IJKMK010, IJKMK005 and IJKMK006 had the highest (246.8; 235.8) and lowest (82.7) yield/m² among all studied populations respectively. The populations IJKMK005 with 54.8% and IJKMK009 with 53.0% ranked the highest and lowest in terms of oil content, while the protein content of seeds differed from 18.4% to 19.5% for the populations IJKMK003 and IJKMK009.

Among the all traits correlated between each other, the protein content recorded the highest negative association with absolute weight of seeds followed by oil content of the seeds ($r = -0.650^{**}$; $r = -0.654^{**}$) (table 2). The percentage of the oil in seeds had a negative and considerable correlation with the height of the plants ($r = -0.776^*$). The seed yield per plant had a positive and significant correlation with number of capsule per plant ($r = 0.949^*$) and very low correlation with height of the plants ($r = 0.0069$). The length of the cotyledons had a negative and considerable correlation with vegetation period of examples ($r = -0.625^{**}$), while absolute weight of the seed were positive significant correlation with length of internodes ($r = 0.561^*$) (table 2).

An examination of the data on seed yield and its components reveals that population IJKMK005 gave the best performance in terms of capsule number/plant (200), yield/plant (29.4) and absolute weight of the seed (3.6 g). The capsule number/plant found in this study was somewhat higher than average capsule number reported in literature (Sevgi et al., 2004; Adebisi et al., 2005).

Knowledge of the interrelationship between seed yield (in our case per m²) and other characters is important to be able to effect selection (Ariyo, 1995). Results present in table 2 clearly reveal positive correlation between seed yield/m² and number of capsule/plant and yield/plant ($r = 0.818$; $r = 0.914$). Also, yield/plant showed a positive correlation with number of capsule/plant ($r = 0.949^*$). These findings are in agreement with those of the earlier workers who found a positive association between single plant yield and number of capsule for sesame (Backiyarami et al. 1998).

Table 2 Coefficient correlation among 11 traits in sesame local populations

Characters	Cotyle- don length	Inter- nodes length	Height	Vege- tation period	Capsule/ plant	Capsule length	Seed/ capsule	Yield/ plant	Yield/m ²	A.W.	Oil %	Protein %
Cotyledons length	1											
Internodes length	-0.048	1										
Height	0.322	-0.405	1									
Vegetation period	-0.625**	0.401	-0.081	1								
Caps./plant	0.220	-0.095	-0.113	0.087	1							
Capsule length	-0.374	0.206	-0.198	0.301	0.026	1						
Seed/ capsule	-0.627	0.125	-0.137	0.094	-0.528	0.466	1					
Yield/ plant	0.199	-0.309	0.007	-0.023	0.949*	0.109	0.452	1				
Yield/m ²	0.205	-0.585	0.291	-0.113	0.818	-0.125	-0.435	0.914	1			
A.W.	-0.018	0.561*	-0.581	-0.069	-0.396	0.189	0.157	0.293	0.033	1		
Oil %	-0.317	0.180	-0.776*	0.183	0.426	-0.079	-0.158	0.349	0.171	0.571	1	
Protein %	0.399	-0.269	0.701	-0.207	-0.397	-0.659	-0.195	-0.418	-0.096	-0.650**	-0.654**	1

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

Conclusion

In summary, top yielding population IJKMK005 could be use as a seed production parents in crop improvement programmes. In general the data which we obtain showed that Macedonia germplasms could be economically beneficial for sesame production and significant breeding material in the future.

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