EVALUATION OF SESAME GERMPLASM FOR GENETIC PARAMETERS AND DISEASE RESISTANCE

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ABSTRACT

One hundred and six genotypes of sesame, collected from different parts of the world, were evaluated during summer 2003 at Nuclear Institute for Agriculture and Biology, Faisalabad, Pakistan. The germplasm was planted in a single row of 2.7 meter length in RCBD in three repeats. Data pertaining to different morphological characters like days to maturity, plant height, branches, capsule number, seeds per capsule, 1000-seed weight and seed yield per plant were recorded and genetic parameters were worked out. Seed yield, capsule number and branches per plant showed high genetic advance combined with heritability. Branches per plant, capsule number also showed highly significant and positive phenotypic correlation with seed yield. The phyllody disease intensity ranged from 3.8 to 20 percent. It may be concluded that disease free germplasm with maximum emphasis on capsule number followed by plant height and branches per plant may be selected and utilized for the improvement of seed yield in sesame.

KEYWORDS: *Sesamum indicum;* germplasm; performance; agronomic characters disease resistance; Pakistan.

INTRODUCTION

Sesame (*Sesamum indicum* L.) is an important oilseed crop being cultivated in the tropics and temperate zone of the world. Its edible oil contains protein content, quality vitamins and aminoacids. Sesame is a source of good quality vegetable oil with antioxidative constituents i.e. sesamolin, sesamin and sesamol (4).

In Pakistan sesame is cultivated on an area of 87.9 thousand hectares with annual production of 19.2 thousand tons. Its seed yield (219 kg/ha) is very low as compared to other leading countries of the world like China, Hondrous and Egypt which are producing 1185, 1133 and 1143 kg seed yield per hectare, respectively (3). The reason for low productivity is that it is cultivated on sub-marginal lands with improper agronomic practices and non-availability of good varieties with resistance to biotic and abiotic stresses. So high yielding varieties with good plant characteristics are needed. Moreover, yield

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is a dependable complex inherited character resulting from interaction of several contributing factors that may be related or unrelated. For formulation of an effective breeding programme, germplasm collection, native races, elite lines and varieties have to be characterized for all morphological, biochemical characters and resistance to various stresses. As seed yield is a polygenic trait, direct selection for this character may be misleading. Hence components that determine the yield are the best indices for selection. In this regard knowledge of association between important morphological attributes and seed yield may be helpful to identify suitable donors for successful breeding programme.

Ganesh and Sakila (5) stressed that plant breeder must know the relationship between yield and yield contributing characters and their association with yield. Padmavathi (9) observed that variability study of existing varieties that are being used for crossing is entirely necessary. He further observed that number of branches, capsule per plant and seed yield had high heritability coupled with genetic advance, indicating pre-dominance additive gene action. Zingzhong and Yishou (15) studied 27 core accessions and three male sterile lines for nine morphological traits. They concluded that capsule number and plant height had significant positive association and direct path coefficient on seed yield. Physiological traits such as reproductive period, plant canopy and harvest index are also important to improve the yield and efforts should also be diverted to utilize these characters in breeding programme (8).

In the present study performance of white and black seeded sesame germplasm, was evaluated for association of morphological attributes and genetic parameters.

MATERIALS AND METHODS

Seventy three genotypes of white seeded and 33 of black seeded sesame germplasm comprising both exotic and indigenous material were planted during summer 2003-2004 at Nuclear Institute for Agriculture and Biology, Faisalabad. Single row of 2.7m^2 of each genotype was sown in three repeats in RCBD keeping inter and intra row spacing of 45 cm and 15 cm, respectively. Morphological data viz. days to maturity, plant height, number of branches, capsule per plant, seeds per capsule, 1000 seed-weight, seed yield per plant and disease percentage regarding phyllody were recorded. The data were subjected to analysis of variance and means were compared with DMR test (13). Correlation coefficients of morphological attributes keeping seed yield as dependable variable and genetic parameters were computed following Singh and Chaudhary (14).

RESULTS AND DISCUSSION

Mean square values of morphological attributes of white seeded sesame indicated highly significant differences in all the traits except number of seeds per capsule where non-significant variance was observed (Table 1). The maximum standard deviation values were estimated in capsules per plant followed by plant height and seed yield per plant. In case of black seeded germplasm the mean square values showed highly significant variance in case of three attributes viz. days to mature, plant height and 1000-seed weight, while branches per plant, capsule number, seeds per capsule and seed yield showed significant differences (Table 2). The standard deviation values were higher in case of seed yield per plant (13.61) followed by plant height (13.40) and capsule number (11.56).

Table 1. Mean and mean square of morphological attributes of sesame (white seeded) germplasm during 2003.

Source of variation	Days to mature	Plant height (cm)	Branches/ plant	Capsule number	Seeds/ capsule	1000-seed weight (g)	Seed yield/ plant (g)
Varieties	65.55**	591.18**	34.08**	15976.00**	87.45NS	.002**	505.71**
Replications	182.83**	1062.67**	172.02**	58355.67**	58.20NS	.001NS	1265.62**
Residual	10.05	267.70	14.91	7999.12	76.55	.0007	266.58
Average	109.44	169.49	9.767	161.75	62.95	0.319	26.31
SD+	4.89	18.71	4.43	99.97	8.90	0.03	18.06

Table 2. Mean and mean square of morphological attributes of sesame (black seeded) germplasm during 2003.

Source of variation	Days to mature	Plant height (cm)	Branches/ plant	Capsule number	Seeds/ capsule	1000-seed weight (g)	Seed yield/ plant (g)
Varieties	68.43**	658.64**	14.74*	8494.80*	94.64*	.001271**	276.25*
Replications	10.70*	305.16NS	7.80NS	15679.17*	51.87NS	.001274NS	475.24*
Residual	3.21	245.08	9.28	4722.69	58.18	.000504	155.08
Average	113.28	179.65	8.67	133.80	60.2	0.43	20.80
SD+	1.64	13.40	2.94	11.56	8.20	0.031	13.61

The highly significant variation in all attributes of white seeded genotypes except seeds per capsule may be due to a large number of population of white seeded as compared to black seeded genotypes. In black seeded genotypes only three attributes showed highly significant differences. Further white seeded genotypes had a wide range of variability due to their diverse nature of origin and difference in their genetic makeup. Morphological attributes of selected elite sesame germplasm (Table 3) indicated that genotype NS 3303 produced higher seed yield (52.8g) per plant followed by NS1203 (49.4 g) and NS 903 (48.9 g). Check varieties Til-89 and TS-3 produced 28.9 g and 20.15 g seed yield, respectively. These elite genotypes

also showed earliness in maturity and higher number of capsules per plant. In case of black seeded germplasm (Table 4) higher seed yield was noted in NS 7903 (43.8 g) followed by NS 8603 (36.5 g) and NS 8803 (30.4 g). These high yielding genotypes had more number of branches and capsules per plant. Considering the morphological attributes of white seeded and black seeded genotypes it was revealed that white seeded germplasm had more branches, capsules and seed yield level as compared to black seeded. It means that there is higher number of chances to exploit white seeded genotypes more easily and quickly as compared to black seeded. Also a high level of improvement is possible in white seeded genotypes. Although some elite germplasm was available in black seeded sesame (Table 4) in which improvement may be possible to some extent as compared to check varieties (TS-3 and Til-89) yet the chances are quite less than white seeded germplasm. In some reports it is mentioned that black seeded sesame has a medical edge and premium to white seeded (2).

Table 3. Morphological characteristics of elite sesame (white seeded) genotypes during 2003.

Genotype	Days to mature	Plant height (cm)	Branches/ plant	Capsule/ plant	Seeds/ capsule	1000-seed wt.(g)	Seed yield/ plant (g)
NS 903	107	158	16	262	58.5	3.4	48.9
NS 1203	104	179	12	293	72.7	3.5	49.4
NS 3303	110	166	9	295	69.8	3.4	52.8
NS 3503	106	170	13	365	57.4	3.8	70.5
NS 4403	103	172	12	303	61.7	3.7	42.1
NS 4803	112	172	13	265	62.0	3.2	42.7
NS 5503	106	174	14	226	62.0	3.7	44.4
NS 5903	103	177	14	252	60.3	3.7	43.7
NS 7103	111	164	15	259	65.3	3.2	35.8
TS-3	112	186	7	127	66.8	3.8	20.15
TIL-89	116	174	8	142	62.8	3.7	28.9
LSD 5%	4.42	22.89	5.38	124.71	NS	0.12	22.77
1%	5.83	30.20	7.10	164.49	NS	0.16	30.03

Table 4. Morphological characteristics of elite sesame (black seeded) genotypes during 2003.

Genotype	Days to mature	Plant height (cm)	Braches/ plant	Capsule/ number	Seeds/ capsule	1000-seed wt.(g)	Seed yield/ plant (g)
NS 7903	110	175	9.5	251	58.3	3.4	43.8
NS 8603	110	191	11.0	230	62.0	3.5	36.5
NS 8803	112	182	11.5	161	63.3	3.7	30.4
NS 9303	112	189	10.0	163	63.7	3.4	28.1
NS 9503	112	199	9.0	157	70.5	3.6	27.45
NS 9603	109	184	9.8	196	68.0	3.4	30.0
TS-3	112	186	6.8	127	66.8	3.8	20.15
Til-89	116	174	8.0	142	62.8	3.7	28.9
LSD 5%	2.515	21.96	4.27	96.40	10.70	0.03	17.47
1%	3.329	29.06	5.66	127.60	14.164	0.04	23.12

Correlation coefficients of morphological attributes with seed yield were highly significant and positive with capsule number and branches per plant in both white as well as black seeded germplasm (Table 5). The relationship was positive but non-signifciant in case of plant height, seeds per capsule and 1000-seed weight. However, it was negative with days to mature in both white and black seeded lines. The 1000-seed weight also showed negative correlation in black seeded genotypes. Sharaan and Ghallab (12) evaluated 122 sesame genotypes and found positive correlation of seed yield with branches per plant, capsule number and plant height. Ganesh and Sakila (5) studied 114 sesame genotypes and observed positive association of plant height, branches per plant and capsule number with seed yield. Yingzhong and Yishou (15) also observed a positive correlation of seed yield with capsule number and plant height.

Table 5. Correlation coefficient of morphological attributes of sesame germplasm with seed yield during 2003.

Germplasm	Days to mature	Plant height (cm)	Branches/ plant	Capsule number	Seeds/ capsule	1000-seed weight (g)
White seeded	-.2637	.1879	.5850**	.9322**	.1436	.0538
Black seeded	-.1816	.1515	.4717**	.8876**	.2466	-.045

In white seeded sesame germplasm, maximum heritability was observed in case of days to mature (58%) followed by 1000-seed weight (36.8) while genetic advance was higher for seed yield per plant (25.88%) followed by capsule number (25.47%) and branches per plant (22.75) (Table 6). In black seeded sesame genotypes, higher heritability was estimated in days to mature (83.5%) while maximum genetic advance was computed in seed yield per plant (18.77%) followed by capsule number (16.43%) and branches per plant (8.47%). This indicated that both in white and black seeded germplasms, capsule number, branches per plant and seed yield per plant are governed by additive type of genes. Hence, selection for high seed yield, should be based on these characters. For selection of other characters, more number of population is needed and even much selection stress is needed for their improvement. Johnson *et al.* (6) and Panse (10) have also observed significant role of additive type of genes for yield improvement. They stated that high heritability accompanied with high degree of genetic advance offered the most effective selection criterion due to its base on additive type of genes.

Table 6. Genetic parameters of sesame germplasm 2003.

Character	White seeded		Black seeded	
	Heritability (%)	Genetic advance (%age of x)	Heritability (%)	Genetic advance (%age of x)
Days to mature	58.0	5.33	83.5	5.72
Plant height (cm)	23.0	5.22	29.5	5.43
Branches/plant	24.3	22.75	12.8	8.47
Capsule number	20.0	25.47	16.6	16.43
Seeds/capsule	3.4	0.99	13.5	3.23
1000 seed weight (g)	36.8	7.21	27.5	3.55
Seed yield/plant (g)	18.3	25.88	16.3	18.77

Panse (10) and Sarwar *et al.* (11) also reported that if heritability is high and genetic advance is low, that heritability is mainly due to non-additive genetic effects (dominance or epistasis). Studying 50 genotypes of sesame Padmavathi (9) noted that branches per plant, capsule number and seed yield per plant had high heritability compared with high genetic advance indicating the predominance of additive gene action in controlling these characters.

Among 106 lines, phyllody disease was noted on nine genotypes including approved variety TS-3 (Table 7). The disease intensity was maximum in genotype NS 3103 (20%) followed by NS 9203 (16.66%) and NS 6503 (14.28%) as compared to check variety TS-3 (3.80%). No disease symptom was observed in variety Til-89.

Table 7. Disease reaction (phyllody) on sesame germplasm during 2003.

Genotype	NS-903	NS-2103	NS-2303	NS-2703	NS-3103	NS-3903	NS-6503	NS-9203	TS-3	Til-89
Infection percentage	9.09	11.11	7.14	9.09	20.00	10.00	14.28	16.66	3.80	0

Phyllody or green flowers disease is associated with a mycoplasma like organism (MLO). The disease is transmitted by *Orosius albicinctus* Dist. Its incidence in sesame is sometimes 90-100 percent. At this level of infection it causes total loss of yield. It has been observed that one percent increase in disease intensity reduces the yield by 8.36 kg per hectare (7).

CONCLUSION

It may be concluded that screening of elite genotypes of sesame possessing higher seed yield is possible if selection criterion based on more number of branches, higher number of capsule and disease free plants.

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