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GENETIC VARIABILITY AND CORRELATION STUDIES IN SESAME (*Sesamum indicum L.*)

G. A. IWO, A. A. IDOWU and S. MISARI

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ABSTRACT

Genetic variability of seven yield related traits were estimated including broad sense heritability for 19 genotypes of sesame. The agronomic traits studied were plant height, days to 50% flowering, number of branches/plant, number of capsules/plant, capsule length, seeds/capsule and dry grain yield. All the characters investigated showed high estimate of heritability except capsule length. The heritability values recorded were 94%, 96%, and 72% with corresponding high genetic advance for number of branches/plant, number of capsule/plant and seed yields respectively. These were regarded as indicators for effective selection. Seed yield was positively correlated to number of days to 50% flowering, seeds/capsule and number of capsule/plant at genotypic level with correlation coefficients(r) of 0.37, 0.23, and 0.25 respectively. On the other hand, plant height and number of branches significantly correlated with seed yield at phenotypic level. This maybe attributed to environmental influence. Considerable progress is therefore expected in sesame seed improvement when these characters with positive correlation are considered in choosing selection criteria.

KEYWORDS: Coefficient of variation, Correlation coefficient, Genetic Advance, heritability, Sesame selection.

INTRODUCTION

Sesame (*Sesamum indicum* L.) commonly known as beniseed in Nigeria is an important and very ancient oilseed crop cultivated extensively in Asian countries and drier part of Africa (Joshi, 1961). It is now considered as one of the major cash crops in Nigeria. Sometimes it is cultivated for its leaves and seeds which are used as condiments in making of local vegetable soup (Uzo et.al, 1985). The seeds contain about 50% oil, 25% protein and 11% carbohydrate (Ochse et.al, 1961). Besides, industries in developing countries use sesame oil to improve the shelf life of canned products (Fish, meat etc) because of the stability of its oil (Anon, 1971). Sesame oil and seed products are highly stable against oxidative process (Abou-Gharbia & Shahidi, 2000). The stability is due to the naturally occurring antioxidant such as sesomin and sesamolin. These are preferred in food instead of synthetic food additives (Mohammed & Awatif, 1998). In Nigeria, sesame is grown in the northern and central part of the country as an export crop(Iwo, et.al 1998) mainly in small holdings under the socio-cultural and economic context of the communities. The yield of sesame is still low but varies from one area to another due to lack of improved seeds. On average, 500kg of sesame is harvested per hectare (Alegbejo et.al, 2003) .The high economic potentials, both as source of raw material and foreign exchange earner for the country makes it imperative that concerted efforts have to be made to provide high yielding varieties to the farmers in order to boost sesame production. One of the approaches to bring about improved varieties is to understand the genetic variability of all the yield related traits and how they are associated with yield in sesame. These will be useful as selection indices in breeding programme. According to Oseni (1994) improvement of any crop depends on the magnitude of genetic variability and yield related traits that can be exploited for efficient crop management and enhancement of yield. Earlier work by Adeyemo and Ojo (1991), showed presence of considerable genetic variability of agronomic traits among sesame. Osman and Khidir (1974) had observed high proportion of GCV and PCV indicating presence of considerable fixable genetic variation in traits of sesame. Pathak and Dixit (1992), observed black seeded sesame to have high heritability followed by high genetic advance on some traits such as days to flowering and plant height. These provided the most effective conditions for selection of these traits. The purpose of this study therefore was to investigate the extent of genetic variability of yield related traits in sesame and the association with yield.

MATERIALS AND METHODS

The materials for the study consisted of 19 accessions of sesame obtained from the germplasm maintained by the Oilseeds Research Division at National Cereals Research Institute Badeggi. These were grown during the 1999 and 2000 cropping seasons at Badeggi, Niger State, Nigeria. Experimental design was randomised complete block design and a single row plot of 6 meters were established for each genotype in three replicates .The inter and intra spacing were 60cm and 20cm respectively. Cultural practices such as thinning and hoe weeding at two and three weeks after planting were carried out respectively. Fertilizer application (N.P.K.) at the ratio of 20:30:30 was applied by dibbling a week after weeding. From each row of the genotype, ten plants were randomly selected and assessed for seven agronomic traits. These include days to 50% flowering, plant height, number of branches/plant, number of capsules/plant, capsule length, seeds/capsule and dry grain yield. The genotypic and phenotypic coefficients of variability of the agronomic traits were estimated according to the formula suggested by Singh & Chaudhary (1995):

G. A. Iwo, Department of Crop Science, University of Calabar, P. M. B. 1115, Calabar, Nigeria.
A. A. Idowu, National Cereals Research Institute, Badeggi, P. M. B. Bida, Niger State, Nigeria.
S. M. Misari, Institute of Agricultural Research, Ahmadu Bello University, Zaria, Kaduna State, Nigeria.

$$GCV = \frac{\sqrt{\sigma^2_g}}{\bar{X}} \times 100$$

$$PCV = \frac{\sqrt{\sigma^2_{ph}}}{\bar{X}} \times 100$$

Where σ^2_g = Genotypic variation

$\sigma^2 ph$ = Phenotypic variation

$\bar{X}$ = Population mean

and broad sense heritability (h^2) according to Hanson *et al* (1956)

$$h^2 : = \frac{\sigma^2_g}{\sigma^2_{ph}} = \frac{\sigma^2_g}{\sigma^2_e + \sigma_{ge} + \sigma^2_g}$$

Expected genetic advance was estimated as suggested by Johnson *et al* (1955)

$$G.A = \frac{\sigma^2_g}{\sigma^2_{ph}} \times K\sigma_{ph}$$

Where $K\sigma_{ph}$ = selection differential expressed in phenotypic standard deviation.

Genetic Advance (G. A) as % of the mean =

$$\frac{\sigma^2_g}{\sigma_{ph}} \times \frac{100}{\bar{X}}$$

Where: $\bar{X}$ = general mean of a trait and

Phenotypic correlation was calculated according to procedure suggested by Falconer(1960):

$$rph(xy) = \frac{Mcp(xy)}{\sqrt{(ms(x)(ms(y)}}$$

Where: rph(xy) = phenotypic correlation between x and y
Mcp(xy) = mean cross products of x and y
Ms(x) = mean square for x
Ms (y) = mean square for y

Genotypic Correlation was calculated according to procedure suggested by Mode and Robinson (1959)

$$(r^g) = \frac{*^2_g x. y}{\sqrt{(*^2_g x)(*^2_g y)}}$$

Where: $*^2_g$ x. Y = genetic covariance between the two trait X and Y

$*^2_g$ x. = The genetic variance of trait X

$*^2_g$ Y. = The genetic variance of trait Y

RESULTS AND DISCUSSION

Estimates of genetic variability and broad sense heritability for the agronomic characters studied in sesame are presented in Table 1 The data analysed showed phenotypic coefficient of variability (PCV) to be higher than genotypic coefficient of variability (GCV) in all the investigated yield components. This indicates the presence of environmental component in the variance. Since these genetic estimates (Gcv, Pcv) cannot provide reliable measure of the heritable variations, heritability estimates and genetic advance were used to ascertain the magnitude of heritable variations. All the characters were observed to have high estimates of heritability except capsule length. The observed high heritability of 94%,96%and72% with high genetic advance expressed as percentage of mean for number of branches/plant, number of capsules/plant and seed yields tend to express higher measure of variation.

Table 1: Estimate of genetic variability of some characters in sesame

Characters	Range	Mean	GCV	PCV	h^2(%)	G.A. as % of mean
Days to 50% flowering	40-88	45.6	18.04	20.06	80	16.2
Planting height (cm)	80-150	112.1	12.87	15.94	98	16.7
No. Branches/ Plant	0-5	3.94	118.8	122.3	94	115
No. Capsule/ plant	130-600	193.1	47.66	49.53	96	49.9
Capsule length (cm)	2.4-2.7	2.62	0.66	8.18	0.65	0.05
No. of Seeds/ capsule	52-92	71.59	11.40	14.56	61.3	8.9
Seed yield (gm)	95-450	187.4	33.26	38.97	72.82	38.4

Table 2: Genotypic and Phenotypic Correlation of Agronomic Traits with seed Yields in Sesame

Characters	Yields	
	Genotypic	Phenotypic
Days to 50% flowering	0.379**	0.321**
Plant height (cm)	-0.115 NS	0.243*
No. Branches/Plant	-0.224 NS	0.372**
No. Capsule/Plant	0.257*	0.0062 NS
Capsule length (cm)	-0.328 NS	0.079 NS
No. of Seeds/Capsule	0.231*	-0.123 NS

Significant level
* P = 0.05
** P = 0.01

NS = Not significant

According to Pathak and Dixit (1992) this condition is due to additive gene action. This gives the most effective condition for selection. High estimate of heritability with low genetic advance (GA) in characters such as days to 50% flowering plant height, and number of seeds/capsule tend to be influenced by non-additive gene action ie. dominance and epistasis (Liang and Walter 1968) and selection would be slow. The results obtained under the present investigation are in conformity to those of Debral and Molker (1971). The correlation coefficients of yield components with grain yield are presented in table 2. Seed yield was positively correlated to number of days to 50% flowering, seeds/capsule and number of capsule/plant at genotypic level while plant height and number of branches significantly correlated with yield at phenotypic level. These indicate the present of considerable genetic variability among the investigated sesame accessions and also the role of environmental effect especially in plant height. However, seed yield showed negative correlation with the length of capsule at both genotypic and phenotypic level, showing no possibility of considering capsule length as an index for selection in sesame. These results on correlation conformed with the previous reports of Pathak and Dixit (1992) for black seeded sesame. A positive association of yield with the number of capsules was also reported by Varisai and Stephen (1964), Gupta and Gupta (1977).

Generally the study indicated that sufficient genetic variability exists in most of the yield related components under study. The high heritability and genetic advance obtained for number of branches, capsules/plant and seed yield shows the possibility of their improvement through selection. The positive correlation of some of the components with yield also indicated possible use of these characters as reliable selection indices.

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