Progressive Research – An International Journal
Vol. 5 (Special Issue) : 478-481 (2010), ISSN : 0973-6417

Society for Scientific Development in Agriculture and Technology, Meerut (U.P.) INDIA

ROLE OF GENETIC VARIABILITY FOR IMPROVEMENT IN NIGER (*GUIZOTIA ABYSSINICA* CASS.)

Sanjay Kumar[1], Shanti Bhushan[2]*, Birendra Prasad[1] and Sohan Ram[3]

[1]*Regional Research Station, Agwanpur, Sahrsa, Bihar (RAU, Pusa, Samastipur)*

[2]*Agricultural Research Institute, Mithapur, Patna (RAU, Pusa, Samastipur)*

[3]*Deptt. of Plant Breeding and Genetics, Birsa Agricultural University, Kanke, Ranchi, Bihar*

***Corresponding author** (Shanti Bhushan) **Email :** shantidixit@rediffmail.com*

ABSTRACT

A broad spectrum of variability was visualized in almost all characters, mainly in plant height, number of primary branches per plant and secondary branches per plant, number of capitulum per plant, days to 50 per cent flowering and days to maturity. Analysis of variance also supported the existence of distinct genetic differences among the germplasm for all the characters studied. Genotypic coefficient of variation was appreciable in number of capitulum per plant, plant height, number of primary branches per plant, capitulum diameter, seed yield per plant, number of secondary branches per plant and 1000-seed weight. These characters also expressed moderate heritability estimates. Selection based on these characters would give more progress that based on other characters.

Key words : *Genetic variability, heritability, quantitative traits niger.*

Niger (*Guizotia abyssinica cass.)* is one of the important oil seed crop of India belonging to family composite. Though it is considered as minor oil seed crop both at global and national level, still it has considerable importance in rain fed condition especially on hill slopes and coarse textured soil. It is very important oil seed crop in term of oil content, quality and potentiality. The important feature of this crop it that it gives reasonable seed yield even under poor growing condition. Niger is growing in tropical and sub tropical countries like India, Ethiopia, East Africa. India and Ethiopia are two major niger producing countries in the world.

India is a major Niger growing country accounting for more than 50 percent of world Niger area as well as production Madhya Pradesh, Jharkhand, Orissa, Maharastra, Karnataka and Tamil Nadu are the major Niger producing states.

MATERIALS AND METHODS

The present investigation was carried out during kharif 1997 at the Niger experimental plot of Ranchi Agriculture College, Birsa Agricultural university, Ranchi. The experimental material consisting of 72 genotypes of Niger. The seed were sown in Randomized Block Design (R.B.D.) with three replication on the rows 30 cm apart. Intra row plant distance of 10 cm was maintained by thinning after 25days of sowing. The observations were taken on five randomly selected plants from middle row in each germplasm in each replication for nine quantitative attributes such as plant height (cm), number of primary branches per plant, number of secondary branches per plant, Number of capitulam per plant, Capitulam diameter (cm), 1000 seed weight (g), Days to 50% flowering, Days to maturity, Yield per plant (g). The analysis of variance was done by the procedures as described by Panse (1956) and sukhatme (1967). The phenotypic coefficient of variation was calculated by dividing the square root of phenotypic variance and Genotypic coefficient of variation by the population mean and multiplying by 100 (Burton, 1952). Heritability (h^2), in the broad sense and genetic advance were calculated according to (Lush, 1949).

RESULTS AND DISCUSSION

Phenotypic variability for all the nine quantitative characters were calculated in 72 germplasm lines and is presented in table-1 Results revealed that extent of variability was enormous for the characters, namely number of capitulum per plant which ranged from 21.60 to 61.73 followed by number of primary branches per plant (5.33-11.73), and number of secondary branches per plant (10.40-21.60). Appreciable amount of variability was also observed for plant height, capitulum diameter, and seed yield per plant, while range of variability was narrow for the characters such as days to 50 per cent flowering, days to maturity and 1000 seed weight. Estimate of standard error difference form

mean was maximum in the characters, number of capitulum (4.57) followed by plant height, number of secondary branches per plant, while it was negligible for days to 50 percent flowering, number of primary braches per plant, days to maturity, seed yield per plant and capitulum diameter.

Analysis of variance, presented in table-2, reveals that variance of most of the characters studied were highly significant except capitulum diameter, 1000 seed weight and seed yield per plant. Analysis of genetic parameter as evident from the table-3, the highest phenotypic variance was recorded for plant height (125.40), which was followed by number of capitulum per plant (105.89). Phenotypic variation, however was low for the characters like capitulum diameter (0.03), seed yield per plant (0.19) and 1000- seed weight (0.25). Similar trend was also observed at genotypic and environmental levels for all the nine characters studied. Genotypic variance was highest (77.71) for plant height followed by 42.35 for number of capitulum per plant. There was least genotypic variance for the character capitulum diameter. Environmental variance was maximum for number of capitulum per plant (63.53) followed by plant height (47.69). Some sort of parallelism was observed between phenotypic and environmental variances for days to 50 per cent flowering, number of secondary branches per plant form 30.14 per cent for number of primary branches per plant. The phenotypic coefficient of variation ranged from 30.14 per cent for number of capitulum per plant to 2.77 per cent for days to 50 per cent flowering (table-5). It was moderate for number of secondary branches per plant (23.80 percent), number of primary branches per plant (23.45per cent), capitulum diameter (17.26 per cent), plant height (17.12 per cent), seed yield per plant (16.16 per cent) and 1000-seed weight (11.05 per cent). While for days to maturity (3.36per cent), and days to 50 per cent flowering it had relatively lower value. One the other hand, the genotypic coefficient of variation ranged from 19.06 per cent for number of capitulum per plant to 1.23 per cent for days to 50 per cent flowering.

Characters like plant height (13.47 percent), number of primary branches per plant (12.67 per cent) gave relatively higher coefficient of variation than capitulum diameter (9.48 per cent), seed yield per plant (9. 38 per cent), number of secondary branches per plant (8.78 per cent) and 1000-seed weight (9.94) per cent had moderate genotypic coefficient of variation. Days to maturity (3.12 per cent) expressed lower value of genotypic coefficient of variation and virtually no variation (1.23 per cent) for days to 50 per cent flowering.

Heritability in broad sense was recorded in table-5 which reveals highest heritability for days to maturity (85.82 per cent) and lowest for number of secondary branches per plant (13.63 per cent). The characters, namely days to maturity, plant height, number of capitulum per plant and 1000- seed weight gave high to moderate heritability of 85.82, 61.97, 40.00, and 39.48 per cent, respectively. However, heritability was not of appreciable magnitude for seed yield per plant (33.71 per cent), capitulum diameter (30.19 per cent), number of primary branches per plant (29.20 per cent), days to 50 per cent flowering (19.56 per cent) and for number of secondary branches per plant (13.63 per cent). Genetic advance ranged from 14.29 for plant height to 0.11 for capitulum diameter (Table-4). It was highest (14.29) in plant height followed by 8.47 in number of capitulum per plant and 5.93 in days to maturity. Number of primary branches per plant though gave more than a unit (1.02) but in other characters, namely 1000- seed weight (0.40), seed yield per plant (0.30), days to 50 per cent flowering (0.69) and number of secondary branches per plant (0.13) genetic advance was negligible being lowest for capitulum diameter (0.11). The genetic advance, expressed as the per cent of mean showed mean showed maximum value for number of capitulum per plant (24.83) followed by plant height (21.85). Number of primary branches per plant (14.10), seed yield per plant (11.22) and capitulum diameter (10.73) gave considerable genetic advance over their means. However in 1000-seed Wight (8.98), number of secondary branches per plant (6.68), and days to maturity (5.95), it was minimum plant being negligible for days to 50 per cent flowering (1.12).

Means and range of variation for different quantitative traits under the present study have revealed the existence of considerable amount of variability among niger germplasms. A distinct variation in plant height, number of primary branches per plant, secondary branches per plant and capitulum per plant, days to 50 per cent flowering and days to maturity was indicated. Analysis of variance has also supported the existence of distinct genetic differences among the germplasms for all the characters studied (Table-2). Goyal and Kumar (1985), Adhanom (1986), Borole and patil (1997) in niger and sheriff and Appadurei (1985) in sunflower

Table-1 : Range, mean and S.E. difference from mean for various characters in Niger.

Characters	Range	General Mean	S.E. difference from mean
Plant Height (cm)	47.06 - 84.33	65.40	03.96
No. of Primary branches per plant	05.33 - 11.37	07.30	00.82
No. of Secondary branches per plant	10.40 - 21.60	14.89	01.89
No. of capitulam per plant	21.60 - 61.73	34.13	04.57
Capitulam Diameter (cm)	00.79 - 1.35	01.03	00.08
1000 seed weight (g)	03.62 - 5.84	04.73	00.22
Days to 50% flowering	60.33 - 69.88	62.32	00.89
Days to Maturity	95 - 106	99.64	00.72
Seed yield per plant (g)	02.16 - 3.64	02.74	00.20

Table-2 : Analysis of Variance in randomized block design in Niger.

		Mean sum of squares								
Sources of variance	D.F.	Plant height (cm)	No. of Primary branches per plant	No. of Secondary branches per plant	No. of capitulam per plant	Capitulam Diameter (cm)	1000 seed weight (g)	Days to 50% flowering	Days to Maturity	Seed yield per plant (g)
Replication	2	401.84	1.16	0.70	83.69	0.40	1.30	3.28	0.31	0.31
Treatment	71	280.84	4.64**	15.98**	190.59**	0.05	0.44	4.15**	30.60**	0.32
Error	42	47.69	2.07	10.85	63.53	0.02	0.15	2.40	1.59	0.12

have also reported abundance of variability for different yield attributes in their studies.

Number of capitulum per plant, plant height, number of primary branches per plant, capitulum diameter, seed yield per plant, number of secondary branches per plant and 1000-seed weight have expressed appreciable amount of genotypic coefficient of variation. As genotypic coefficient of variation represents the portion of heritable variation, selection based on the characters expressing sufficient genetic coefficient of variation such as, number of capitulum per plant, number of primary branches per plant, plant height, capitulum diameter would give more progress than based on the other characters. But genotypic coefficient of variation is not alone regarded for estimation of heritable variation, Burton (1952) has suggested that genotypic coefficient of variation along with heritability estimates would give the best picture of progress to be expected from selection.

The hereditability of metric characters is one of the most important properties. The most important function of heritability in the genetic study is its productive role, expressing the reliability of the phenotypic value of an individual which can be directly measured whereas the breeding values determine their influence in the next generation. Therefore, if the breeder chooses individuals according to their phenotypic values, his success in changing the characteristics of the population can be predicted only from a knowledge of degree of correspondence between phenotypic values and breeding values, which is measured by heritability.

In the present investigation appreciable amount of hereditability is obtained for days to maturity, plant height, number of capitulum per plant, 1000-seed weight, seed yield per plant, capitulum diameter, number of primary branches per plant, days to 50 per cent flowering and number of secondary branches per plant. Similar results were also reported by Channarayaeppa (1987), Mishra et al. (1992); patel et al. (1993) in niger and Pandey et al. (1997) in safflower. Plant height, number of capitulum per plant, seed yield per plant, capitulum diameter, number of primary branches per plant and number of secondary branches per plant expressed high genotypic coefficient of variation with high heritability estimates (Table-4). Singh and Yadav (1986) and Borole and Patil (1997) have observed similar trend in sunflower and niger respectively. This shows that these characters can be improved by adopting appropriate breeding methodology, as Johnson et al. (1955) suggested that higher estimates of heritability need not be associated with high values of genetic advance, as was obtained in days to maturity and 1000-seed weight (Table-4) in the present investigation.

Table-3 : Estimation of Phenotypic, Genotypic and Environment variance for quantitative characters in Niger.

Characters	Variance		
	Phenotypic (^{2}p)	Genotypic (^{2}g)	Environment (^{2}e)
Plant height (cm)	125.40	77.71	47.69
No. of Primary branches per plant	2.93	0.85	2.07
No. of Secondary branches per plant	12.56	1.71	10.85
No. of capitulam per plant	105.89	42.35	63.53
Capitulam Diameter (cm)	0.03	0.00	0.02
1000 seed weight (g)	0.25	0.09	0.15
Days to 50% flowering	2.58	0.58	2.40
Days to Maturity	11.26	9.67	1.59
Seed yield per plant (g)	0.19	0.06	0.12

Table-4 : Phenotypic and genotypic coefficient of variation, Heritability, Genetic Advance percentage of Mean for different Characters in Niger.

Characters	Phenotypic coefficient of variation (%)	Genotypic coefficient of variation (%)	Heritability (Broad sense) (%)	Genetic Advance	Genetic Advance percentage of Mean
Plant height (cm)	17.12	13.47	61.97	14.29	21.85
No. of Primary branches per plant	23.45	12.67	29.20	1.02	14.10
No. of Secondary branches per plant	23.80	8.78	13.63	0.99	6.68
No. of capitulam per plant	30.14	19.06	40.00	8.47	24.83
Capitulam diameter (cm)	17.26	9.48	30.19	0.11	10.73
1000 seed weight (g)	11.05	6.94	39.48	0.40	8.98
Days to 50% flowering	2.77	1.23	19.56	0.69	1.12
Days to maturity	3.36	3.12	85.82	5.93	5.95
Seed yield per plant (g)	16.16	9.38	33.71	0.30	11.22

REFERENCES

1. Adhanaon, T.M. (1986). Varitaion in Ethiopian Niger (Guizotia abyssinica Cass.) PGRC-IL CA- *Germplasm-Newsleter 11:*19-22.
2. Borole, R.D. and Patil, H.S. (1997). Genetic variability, correlation and path analysis in Niger. *J. of Oilseed 14(1):* 40-43.
3. Burton, G.W. (1952). Quantitative inheritance in grasses. *Proc. 16th int. Grasld. Cong. 1:* 277-83.
4. Channarayaeppa (1987). Response to selection, correlation and path analysis in Niger (*Guizotia abyssinica* Cass.) *Mysore J. of Agril. Sci. 21 (1):* 92-93.
5. Goyal, S.N. and Kumar, S. (1985). Correction and path analysis in Niger (*Guizotia abyssinica* Cass.) *J. oil seeds Res. 2:* 34-38.
6. Johnson, H. W., Robinsons, H.F. and Comstock (1955). Genotypic and phenotypic correlation in soyabean and their implications in Selection. *Agron. J. 47:* 477-80.
7. Lush, J.L. (1949). Heritability of Quantitative characters in farm animals. *Proc. 8th int. Cong. Genet. (*1948): 356-75.
8. Mishra. A. ; Sarkar, J, M and Basu, N.C. (1992), Genetic variability of certain quantitative character in Niger (*Guizotia abyssincia* Cass.). *Environment and Ecology 10(3):* 511-513.
9. Pandey, N.K. : Gupta. S.C.; Nagda, A. K. (1997). Path analysis of some yield contributing trait in safflower. *Plant Breeding abst. 67(8):* 1164.
10. Panse, V.G. (1956). Genetics of quantitative characters in relation to plant breeding. *Indian J. Genet. Pl. br. 17 (2):* 318-27
11. Patel, O.P.; Mishra, R.K. and Yadav, R.K. (1993) . Variability and correleation in Niger (*Guzotia abyssinica* Cass.) *Advance in plant sci. 6 (2):* 186-190.
12. Sheriff, N.M. : Appaduri, R. (1985). Genetic Variability in some quantitative traits of Sunflower, *Madras Aric. J. 72 (9):* 539-540.
13. Singh, J.V.; Yadav, T.P. (1986). Variability studies of some quantitative characters in sunflower. *J. of oilseeds Res. 3 (1):* 125-127.
14. Sukhatme, P.V. (1967). Statistical methods for Agricultural workers. I.C.A.R, New Delhi.