Plant Archives Vol. 17 No. 1, 2017 pp. 115-117 *ISSN 0972-5210*

ANALYSIS OF GENETIC DIVERGENCE IN NIGER [*GUIZOTIA ABYSSINICA* (L.F.) CASS.] GERMPLASM

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Abstract

The experiment was conducted at the JNKVV, Zonal Agricultural Research Station, AICRP on Niger, Chhindwara (M.P), India; during *kharif* 2015-16. A field experiment was conducted with 114 niger germplasm to study the genetic divergence using Mahalanobis D^2 statistics were grouped into 8 clusters. The results revealed considerable amount of genetic diversity. Cluster II had the maximum number of 90 genotypes followed by cluster I with 18 genotypes. The intracluster distance ranged from 0.00 to 84.52. The highest intra cluster distance was observed for cluster I (84.52) followed by cluster II (81.89). The intercluster D^2 values ranged from 31.04 to 1325.05, the maximum intercluster distance was observed the cluster VII and VIII (1325.05) followed by clusters V and VIII (1137.12) and II and VIII (945.08), which indicated that the genotypes included in these clusters will give high heterotic response and thus better segregants. On this basis of the maximum inter cluster values and *per se* performance for seed yield/plant and 1000 seed weight, the genotypes (JNS-521, JNS-599, JNS-216) were identified as potential parents in future endeavors for improvement of niger.

Key words : Genetic diversity, niger, germplasm of niger.

Introduction

Niger (*Guizotia abyssinica* l.f cass) is an important minor oilseed crop grown in Tropical and Subtropical countries like India, Ethiopia, East Africa, West Indies and Zimbabwe. India ranks first in area, production and export of niger in the world. India and Ethiopia are two major producers. Niger though a native of tropical Africa, is wide spread and cultivated extensively in India since long. It is the lifeline of tribal agriculture and economy in India. It is grown by tribal's on marginal and sub marginal lands with negligible inputs under rainfed condition (Ranganatha, 2009). D^2 statistics doveloped by Mahalanobis (1936) is a powerful tool to measure genetic divergence among genotypes in any crop. Very little work has been reported regarding divergence in niger.

Genetic variability and divergence are of greater interest to the plant breeder as they play a vital role in farming a successful breeding programme. The nature and magnitude of genetic divergence in a population is essential for selection of diverse parents, which upon hybridization leads to wide spectrum of gene recombination for quantitatively inherited traits. The objective of this research was to study the magnitude of genetic divergence and performance of character means in different clusters of Niger genotypes.

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Materials and Methods

The present experiment 'Analysis of genetic divergence in niger [*Guizotia abyssinica* (l.f.) cass.] germplasm' was conducted at the Zonal Agricultural Research Station, AICRP on Niger, Chhindwara (M.P), India; during *kharif* 2015-16. The materials for the present study comprised of 114 niger germplasm. The soil of the experimental site is sandy soil and the crop was raised under the rainfed situation. Each genotype was sown in 2 rows of 4m length spaced at 30cm with interplant distance of 10cm. The experiment was laid out in RBD with 2 replications. In each entry five plants were randomly tagged and observation were recorded for seven characters *i.e.* days to 50% flowering, days to maturity, plant height (cm), number of productive branches/plant, number of capitula/plant, 1000 seed weight and seed yield per plant. The analysis of genetic divergence was carried using Mahalanobis (1936) D^2 statistics. The genotypes

were grouped in clusters by the Tocher's method as described by Rao (1952) and intra and inter cluster distance were estimated as per Singh and Chaudhary (1977).

Results and Discussion

The analysis of variance showed significant differences among the genotypes for all the traits studied. Based on D^2 statistics, the 114 genotypes were grouped into 8 clusters with variable numbers of genotypes revealing the presence of considerable amount of genetic diversity in the material. Cluster II had the maximum number of genotypes (90) followed by cluster I with (18) genotypes. The clusters I and II together included (108) genotypes reflecting a narrow genetic diversity among them. The rest of clusters III, IV, V, VI, VII and VIII were solitary clusters demonstrating the impact of selection presence in increasing the genetic diversity. This was in agreement with the earlier findings of Thangavelu and Rajsekaran (1983). Murthy and Arunachalam (1968) have suggested that genetic drift and forces of natural selection over diverse environmental condition within a country could cause considerable diversity compared to geographical isolation.

The average intra and inter cluster distance are presented in table 2. The intra cluster distance ranged from 0.00 to 84.52 with highest intra cluster distance for cluster I (84.52) followed by cluster II. Such intra cluster genetic diversity among the genotypes could be due to heterogeneity, genetic architecture of the populations.

The inter cluster D^2 values ranged from 31.04 to 1325.05, the maximum intercluster distance was observed between the clusters VII and VIII (1325.05) followed by cluster V and VIII (1137.12) and II and VIII (945.08) indicated the presence of greater diversity between

Table 1 : Distribution of genotypes of niger in different clusters.

Cluster	Genotypes	Total number of genotypes
I	JNS-206,JNS-501, JNS-508, JNS-509, JNS-513, JNS-515, JNS-516, JNS-517, JNS-518, JNS-519, JNS-520, JNS-533, JNS-535, JNS-536JNS-544, JNS-552, JNS-565 and JNS-595	18
II	JNS-29, JNS-119, JNS-126, JNS-503, JNS-504, JNS-505, JNS-510, JNS-511, JNS-512, JNS-514, JNS-522, JNS-523, JNS-524, JNS-525, JNS-526, JNS-527, JNS-528, JNS-529, JNS-530, JNS-531, JNS-532, JNS-537, 538, JNS-539, JNS-540, JNS-541, JNS-542, JNS-543, JNS-545, JNS-546, JNS-547, JNS-548, JNS-549, JNS-550, JNS-551, JNS-553, JNS-554, JNS-556, JNS-557, JNS-558, JNS-559, JNS-560, JNS-561, JNS-562, JNS-563, JNS-564, JNS-566, JNS-567, JNS-567, JNS-568, JNS-569, JNS-570, JNS-571, JNS-572, JNS-573, JNS-574, JNS-575, JNS-576, JNS-577, JNS-578, JNS-579, JNS-580, JNS-581, JNS-582, JNS-583, JNS-584, JNS-585, JNS-586, JNS-587, JNS-588, JNS-589, JNS-590, JNS-591, JNS-592, JNS-593, JNS-594, JNS-596, JNS-597, JNS-598, JNS-600, JNS-601, JNS-602, JNS-603, JNS-604, JNS-605, JNS-606, JNS-607, JNS-608, JNS-609, JNS-610, JNS-611	90
III	JNS-555	1
IV	JNS-534	1
V	JNS-216	1
VI	JNS-507	1
VII	JNS-599	1
VIII	JNS-521	1

Table 2 : Intra (diagonal) and Inter Cluster Distance among 8 clusters in niger.

	I	II	III	IV	V	VI	VII	VIII
I	84.52	363.62	498.00	411.66	715.11	186.85	838.95	330.11
II		81.89	226.58	251.94	305.94	533.67	306.49	945.08
III			0.00	31.04	32.45	358.53	99.88	934.49
IV				0.00	107.21	257.85	197.80	869.97
V					0.00	557.96	53.65	1137.12
VI						0.00	787.73	338.36
VII							0.00	1325.05
VIII								0.00

Table 3 : Character means in different clusters of niger genotypes.

	X_1	X_2	X_3	X_4	X_5	X_6	X_7
I	46.28	92.77	10.27	41.31	99.44	4.42	4.38
II	46.98	109.50	10.46	39.94	99.60	4.48	5.32
III	47.00	108.00	8.60	26.60	100.00	4.80	6.80
IV	45.00	104.80	11.20	26.60	97.00	4.60	5.80
V	47.00	112.00	8.00	24.40	103.00	4.80	5.30
VI	48.00	90.00	7.80	30.20	97.00	4.60	4.50
VII	46.00	115.60	11.20	26.60	105.00	4.20	9.80
VIII	49.00	82.40	9.40	37.40	112.00	4.40	5.10

X_1 = Days to 50% flowering X_2 = Plant height (cm) X_3 = No of productive branches/plant
X_4 = No of capitula/plant X_5 = Days to maturity X_6 = 1000 seed weight (g)
X_7 = Seed yield/plant (g)

genotypes of these graphs (table 2). Hence, crossing between belonging to these cluster may result in high heterosis which could be exploited in crop improvement. Genotypes belonging to the clusters with maximum inter cluster distance are genetically more divergence and hybridization between genotypes of divergent clusters are likely to produce wide variability with desirable segregants. The minimum inter cluster distance was observed between clusters III and IV (31.04) indicating the close relationship and similarities for most of the traits of the genotypes in these clusters.

The cluster mean value for seven traits towards divergence is presented in table 3. The data revealed that considerable differences existed among the clusters for most of the characters studied. The cluster VII (JNS-599) recorded the highest mean values for three characters *viz*; plant height, number of productive branches/plant and seed yield/plant. The cluster VIII (JNS-521) showed the highest mean values for characters like days to 50% flowering and days to maturity. Thus, the genotypes of out standing mean performance from these clusters may be identified as potential parents and could be utilized in hybridization programme for developing high yielding varieties in niger.

The data on inter clusters distance and per se performance of genotypes were used to select genetically diverse and agronomically superior genotypes. On this basis of the maximum inter cluster values and *per se* performance for seed yield/plant and 1000 seed weight, the genotypes (JNS-521, JNS-599, JNS-216) were identified as potential parents in future endeavors for improvement of niger.

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