International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(6): 334-338

Received: 14-09-2019
Accepted: 17-10-2019

Suvarna
Assistant Professor, Department of Genetics and Plant Breeding, College of Agriculture, Raichur, Karnataka, India

Shankuntala NM
Department of Seed Science and Technology, College of Agriculture, Raichur, Karnataka, India

Lokesha R
Department of Genetics and Plant Breeding, College of Agriculture, Raichur, Karnataka, India

Corresponding Author:
Suvarna
Assistant Professor, Department of Genetics and Plant Breeding, College of Agriculture, Raichur, Karnataka, India

Genetic study of niger (*Guizotia abyssinica* (L.f.) Cass) Germplasm for seed yield and its attributing traits

Suvarna, Shankuntala NM and Lokesha R

Abstract
An experiment was conducted in two replications with seventy germplasm lines during *kharif* 2012 at College of Agriculture, UAS, Raichur. The germplasm included 30 local varieties from different parts of Karnataka and 40 lines collected from AICRP, Jabalpur. Each entry was sown in three lines of 4 m length with 30 cm x 10 cm spacing. Out of seventy lines sixty two entries were germinated. These lines were evaluated for seed yield and other ancillary characteristics viz., days to 50% flowering, days to maturity, plant height, number of primary branches, number of capitula, number of seeds per capitulum and seed yield. Among them, six entries performed better than check variety No. 71 and 12 entries performed better than another check variety RCR 18. Among all the entries N-84 (238.89 kgha^{-1}) and SD-33 (215.28 kgha^{-1}) produced high yield. Hadagali local and No. 71 (51.5 days) were found earliest in flowering and maturing varieties and SP 141 was late in flowering (71 days) and late in maturing. Tavaregere local (66.5 cm) and SP134 had less plant height (67.5 cm) and BMD 127 had highest (113.5 cm) plant height. The number of primary branches was more in the genotype Humnabad local (12.5). Number of capsules plant^{-1} were more in Humnabad local and ICP 76 (53.0) and number of seeds capsule^{-1} were more in BMD 115 (77.0). Correlation studies revealed that plant height and number of seeds per capsule were positively correlated with seed yield. The 62 studied germplasm lines were clustered into two clusters.

Keywords: Niger, *Guizotia abyssinica*, germplasm, seed yield, correlation, cluster analysis

1. Introduction
Niger (*Guizotia abyssinica* (L.f.) cass) is a minor oilseed crop in India, cultivated on a marginal and sub-marginal lands, hilly areas, sloppy areas and around forest lands. The crop is capable of yielding well even under conditions of poor soil fertility, moisture stress and crop management. It has tolerance to insect pests, diseases and attack of wild animals.

Niger seed contains 35 to 45% oil, 20% protein and 12% soluble sugars. Both seed and oil are edible. No anti nutrients are present in niger seeds. The oil is rich in linoleic acid (45-70%) and oleic acid (15-40%) and stearic acid (8%). The oil has good aroma and mainly consumed by tribal people. The cake, though edible is mostly utilized as organic manure. Niger has an export potential and seed is exported to many foreign countries as a bird feed.

In India the major niger growing states are Madhya Pradesh, Orissa, Chhattisgarh, Maharashtra, Karnataka, Andhra Pradesh and less area is found in other states Assam Gujarat, Jharkhand, West Bengal and Dadra and Nagar haveli. The total area under niger in India during 2009-10 is 375.5 thousand ha and production is 99.9 thousand tonnes and productivity is 266.2 kg/ha. The more area under niger is contributed by the three states Madhya Pradesh, Orissa, Chhattisgarh, but the productivity was more in Dadra and Nagara haveli followed by Gujarat and Assam. The crop is usually grown in *kharif* season, but in Orissa it is also cultivating in rabi season. The productivity of niger crop is low because of its cultivation in unproductive land and lack of high yielding and fertilizer responsive varieties. To improve the yield of niger and also oil content, one has to collect good genetic resources and evaluate them for important traits. So that these can be utilized in breeding programme to improve the yield of niger. With this objective the experiment was conducted during *kharif* 2012 to evaluate the germplasm for seed yield and yield attributing characters and correlation studies and genetic diversity studies.

2. Materials and Methods

The experiment was conducted at College of Agriculture, Raichur, University of Agricultural Sciences, Raichur, during *kharif* 2012. The experiment included evaluation of seventy germplasm lines laid out in Randomized Block Design, in two replications. The germplasm included 30 local varieties from different parts of Karnataka and 40 lines collected from AICRP, Jabalpur. Each germplasm line was sown in three lines. Out of seventy germplasm lines, sixty two lines were germinated and the same were evaluated for seed yield and other ancillary characters i.e. days to 50% flowering, days to maturity, plant height, number of primary branches, number of capitula, number of seeds per capitulum and seed yield. Five plants were taken for observations in each germplasm. Mean of the five plants was taken as the character mean of that germplasm. Analysis was carried out as per RBD analysis for all the characters. Descriptive statistics, Pearson correlation coefficient and cluster analysis was carried out in SPSS software. Hierarchial cluster analysis was carried out using wards method.

3. Results and Discussion

From the analysis of variance, it indicates that there was significant differences existed among the collected material for all the characters studied. The characters seed yield (kg/ha and g/line) showed maximum variation as revealed by variance (2101.54 and 272.36) followed by number of seeds per capsule and plant height (cm) (Table 1). This indicates that the variation is present among the genotypes evaluated for these characters. While remaining characters number of primary branches showed least variation followed by days to 50% flowering and maturity.

Among the entries evaluated, some promising lines were identified based on yield performance. Among all the entries N-84 (238.89 $kgha^{-1}$) and SD-33 (215.28 $kgha^{-1}$) gave high yield. However, six entries performed better than check variety No. 71 and 12 entries performed better than another check variety RCR 18 for seed yield. Hadagali local and No. 71 were found earliest in flowering (51.5 days) and maturing (84.5 Days) and SP 141 was late in flowering (71 days) and maturing (104 days) (Table 1 and Table 2). Genotypic variations for different characters among niger germplasm is depicted in Figure 1.

Tavaregere local (66.5 cm) and SP 134 (67.5 cm) had less plant height and BMD 127 had highest (113.5 cm) plant height. The number of primary branches was more in the genotype Humnabad local (12.5). Whereas, the number of capsules per plant was more in Humnabad local and ICP 76 (53.0) and number of seeds per capsule was more in BMD 115 (77.0).

Similarly Getinet and Wold (2006) [7] studied the genetic variability of agronomic and seed quality characteristics of 241 niger germplasm collections from different parts of Ethiopia and evaluated. The maturity of the niger accessions ranged from 132 to 168 days. The study indicated that genetic differences for maturity existed among the niger accessions. Sreedhar (2003) [12] reported the variability studies in niger.

A total of 1760 germplasm lines were maintained at project coordinating unit, AICRP on Jabalpur and evaluated 100 germplasm lines for economic traits and classified the germplasm lines into different categories of the character. Similarly 144 germplasm lines during *kharif* 2011 and 197 germplasm lines were maintained and characterized at AICRP centre, UAS, Dharwad during 2012, 200 germplasm at Vanarasi during 2014 (Anonymous, 2011 and 2014) [2, 3]. Genetic variability studies was carried out in niger germplasm and studied the yield and yield attributing characters (Baghel, *et al*., 2018; Vinod and Rajani, 2016) [4, 15].

The results of correlation coefficients revealed that the characters, plant height and number of seeds per capsule was positively correlated with seed yield (Table 4). This indicates that the selection for plant height and number of seeds per capsule will contribute to more yield. Vinod and Rajani (2016) [15] reported the positive correlation of seed length, number of capitula/plant, 1000 seed weight, number of secondary branches per plant and days to 50 % flowering. Similarly correlation studies were carried out in niger germplasm (Ahmed *et al*., 2003, Patil 2003, Patil, and Duhoon, 2005, Thakur and Reddy, 2012, Patil *et al*., 2013, Jagtap *et al*., 2014 and Bisen *et al*., 2015) [1, 10, 17, 11, 8, 5]. Among the characters studied, the positive correlation was found between days to 50% flowering and days to maturity, number of capitula per plant and number of primary branches.

The knowledge of genetic diversity among the germplasm helps in the selection of diverse parents for hybridization and breeding of high yielding, good quality cultivars that will help in increasing production. Hierarchial cluster analysis revealed that the 62 germplasm lines were classified into two clusters (Fig. 2). The genetic divergence studies in niger germplasm using D^2 analysis was reported by Vinod and Rajani, 2017 [16], Bisen *et al*., 2016 [6], Suryanarayana *et al*., 2018 and 2019 [13, 14].

Table 1: Descriptive statistics of the characters studied in the niger germplasm

Character	Minimum	Maximum	Mean	Standard error	Standard deviation	Variance
Days to 50% flowering	51.5	71	58.67	0.68	5.31	28.3
Days to maturity	84.5	104	91.67	0.68	5.31	28.3
Plant height (cm)	66.5	113.5	92.65	1.61	12.71	161.43
Number of primary branches	2	12.5	5.37	0.24	1.85	3.43
Number of capitula per plant	9.5	53	22.65	1.24	9.76	95.31
Number of seeds per capsule	21	77	49.46	1.69	13.3	176.85
Seed yield (g/line)	13	86	36.85	2.096	16.50	272.36
Seed yield (kg/ha)	36.11	238.89	102.35	5.82	45.84	2101.536

Table 2: Mean data of yield and yield attributing characters of niger germplasm

Sl. No.	Entry	DF 50%	DM	PH	# PB	# capitula	# Seeds /capsule	seed yield (g)	Kg/ha
1	Lingasugur local	59.0	92.0	94.0	5.5	23.0	38.5	16.5	45.83
2	Hungund local	57.5	90.5	92.5	5.5	26.5	37.5	21.0	58.33
3	Bagalkot local	60.5	93.5	94.0	6.0	29.5	40.0	24.0	66.67
4	Badam local	52.5	85.5	74.0	5.5	29.0	41.0	27.0	75.00
5	Rona local	52.0	85.0	86.0	2.0	23.0	72.0	58.0	161.11

6	Kustagi local	64.5	97.5	92.0	2.5	17.0	44.0	32.0	88.89
7	Molakalmur local	68.5	101.5	92.0	7.0	18.0	57.5	27.5	76.39
8	Huvinahadagali local	68.0	101.0	81.5	3.3	15.0	41.0	38.5	106.94
9	Hadagali local 1	51.5	84.5	104.5	4.0	19.0	63.5	21.0	58.33
19	Hadagali local 2	67.0	100.0	108.5	5.5	22.0	33.5	35.0	97.22
10	Humnabad local	61.0	94.0	81.5	12.5	53.0	53.5	23.5	65.28
17	Tavagere local	67.5	100.5	66.5	4.0	9.5	68.5	20.0	55.56
18	Gangavati local	67.0	100.0	77.0	5.0	17.5	43.5	16.5	45.83
20	Raichur local	62.5	95.5	96.0	3.5	13.0	43.5	13.0	36.11
21	Indi local	53.5	86.5	95.5	6.0	17.5	34.0	27.5	76.39
22	Ghati local	58.0	91.0	102.5	4.5	18.0	53.0	15.0	41.67
11	RCR 18	62.5	95.5	96.0	9.0	42.0	61.0	42.5	118.06
12	No. 71	51.5	84.5	93.5	6.1	19.0	44.0	51.0	141.67
13	DNC-08-2	54.5	87.5	95.0	4.5	23.0	53.0	38.5	106.94
14	DNC-08-7	53.5	86.5	71.0	4.0	13.0	40.0	18.0	50.00
15	DNC-08-9	60.5	93.5	72.0	4.3	16.5	34.0	16.0	44.44
16	ICP 76	54.5	87.5	88.0	7.7	53.0	48.0	26.0	72.22
23	BMD-21	52.0	85.0	103.5	4.5	36.0	60.5	30.0	83.33
24	BMD-112	54.5	87.5	101.0	3.0	25.0	21.0	28.0	77.78
25	BMD-114	56.5	89.5	108.0	5.0	15.5	54.0	37.5	104.17
26	BMD-115	52.0	85.0	98.5	3.5	12.5	77.0	61.0	169.44
27	BMD-117	56.0	89.0	102.0	8.3	21.0	60.5	44.5	123.61
28	BMD-119	52.0	85.0	94.0	5.5	15.0	32.5	37.5	104.17
29	BMD-120	53.0	86.0	111.5	5.2	13.0	52.5	31.0	86.11
30	BMD-124	59.5	92.5	103.0	4.0	17.5	73.0	52.0	144.44
31	BMD-127	55.5	88.5	113.5	4.5	16.5	61.5	35.0	97.22
32	BMD-131	57.0	90.0	111.0	4.8	20.5	31.0	32.5	90.28
33	BMD-132	60.0	93.0	102.0	4.6	16.0	65.5	35.0	97.22
34	SD-19	61.0	94.0	92.5	5.0	18.0	60.0	57.5	159.72
35	SD-20	55.5	88.5	88.0	4.0	14.5	72.0	61.5	170.83
36	SD-22	58.5	91.5	100.5	5.0	23.0	50.5	62.0	172.22
37	SD-23	64.5	97.5	92.0	8.2	36.0	48.5	24.0	66.67
38	SD-32	53.0	86.0	83.0	6.4	17.0	42.0	34.5	95.83
39	SD-33	65.0	98.0	92.5	5.1	22.0	67.5	77.5	215.28
40	SD-35	64.0	97.0	92.0	5.8	27.5	26.5	42.5	118.06
41	SD-37	53.0	86.0	107.0	5.6	33.0	42.0	66.0	183.33
42	SD-38	52.5	85.5	79.0	4.0	12.5	61.0	32.0	88.89
43	SD-39	53.0	86.0	102.0	4.5	12.5	60.0	59.0	163.89
44	SD-42	60.0	93.0	83.5	5.6	16.5	36.0	22.0	61.11
45	N-76	60.0	93.0	103.5	5.9	22.5	60.0	60.5	168.06
46	N-79	61.0	94.0	82.5	4.1	19.0	28.5	45.5	126.39
47	N-81	61.0	94.0	109.5	9.2	38.0	48.0	64.0	177.78
48	N-83	62.0	95.0	78.5	5.0	20.5	34.0	35.5	98.61
49	N-84	60.0	93.0	99.0	6.3	22.5	42.0	86.0	238.89
50	N-85	56.0	89.0	105.5	8.5	38.5	41.5	45.0	125.00
51	N-96	54.0	87.0	96.0	5.3	27.5	46.5	48.5	134.72
52	N-90	64.5	97.5	103.5	7.0	27.0	43.0	36.5	101.39
53	SP-132	56.5	89.5	112.0	7.0	24.0	44.0	36.5	101.39
54	SP-133	68.0	101.0	98.5	4.0	23.0	55.5	46.0	127.78
55	SP-134	53.0	86.0	67.5	2.5	12.5	44.5	36.0	100.00
56	SP-135	56.0	89.0	99.5	7.0	49.5	74.5	36.5	101.39
57	SP-136	57.0	90.0	103.0	6.5	30.5	46.0	33.0	91.67
58	SP-138	60.0	93.0	90.0	4.5	20.5	40.0	31.0	86.11
59	SP-139	59.5	92.5	69.0	6.3	23.5	66.0	18.0	50.00
60	SP-140	53.5	86.5	68.5	2.0	19.0	49.5	16.0	44.44
61	SP-141	71.0	104.0	74.0	4.5	15.0	35.5	14.5	40.28
62	SP-PCU-172	69.0	102.0	70.5	7.1	13.0	68.0	25.0	69.44
	Mean	58.67	91.67	92.65	5.37	22.65	49.46	36.85	102.35
	SEm±	3.63	3.63	9.06	0.59	1.82	3.41	3.73	10.37
	CD @ 5%	10.18	10.18	25.37	1.65	5.09	9.56	10.45	29.04
	CV(%)	8.76	5.61	13.83	15.51	11.36	9.76	14.33	14.33

DF 50% - Days to 50% flowering # PB – Number of primary branches
DM – Days to Maturity # capitula per plant - Number of capitula per plant
PH – Plant Height (cm) # seeds per capitula - Number of seeds per capitula

Table 3: Mean yield and other characters of selected superior lines

S. No.	Entry	DF 50%	DM	PH	PB	# Capitula	# Seeds / capitula	Seed yield (Kg/ha)
1	N-84	60.0	93.0	99.0	6.3	22.5	42.0	238.89
2	SD-33	65.0	98.0	92.5	5.1	22.0	67.5	215.28
3	SD-37	53.0	86.0	107.0	5.6	33.0	42.0	183.33
4	N-81	61.0	94.0	109.5	9.2	38.0	48.0	177.78
5	SD-22	58.5	91.5	100.5	5.0	23.0	50.5	172.22
6	SD-20	55.5	88.5	88.0	4.0	14.5	72.0	170.83
7	BMD-115	52.0	85.0	98.5	3.5	12.5	77.0	169.44
8	N-76	60.0	93.0	103.5	5.9	22.5	60.0	168.06
9	SD-39	53.0	86.0	102.0	4.5	12.5	60.0	163.89
10	Rona local	52.0	85.0	86.0	2.0	23.0	72.0	161.11
11	SD-19	61.0	94.0	92.5	5.0	18.0	60.0	159.72
12	BMD-124	59.5	92.5	103.0	4.0	17.5	73.0	144.44
13	No. 71	51.5	84.5	93.5	6.1	19.0	44.0	141.67
14	N-96	54.0	87.0	96.0	5.3	27.5	46.5	134.72
15	SP-133	68.0	101.0	98.5	4.0	23.0	55.5	127.78
16	N-79	61.0	94.0	82.5	4.1	19.0	28.5	126.39
17	N-85	56.0	89.0	105.5	8.5	38.5	41.5	125.00
18	BMD-117	56.0	89.0	102.0	8.3	21.0	60.5	123.61
19	RCR 18	62.5	95.5	96.0	9.0	42.0	61.0	118.06
	Mean	58.67	91.67	92.65	5.37	22.65	49.46	102.35
	SE (m) ±	3.63	3.63	9.06	0.59	1.82	3.41	10.37
	CD (P=0.05)	10.18	10.18	25.37	1.65	5.09	9.56	29.04
	CV %	8.76	5.61	13.83	15.51	11.36	9.76	14.33

DF 50% - Days to 50% flowering
DM – Days to Maturity
PH – Plant Height (cm)
PB – Number of primary branches
capitula per plant - Number of capitula plant^{-1}
seeds per capitula - Number of seeds capitula^{-1}

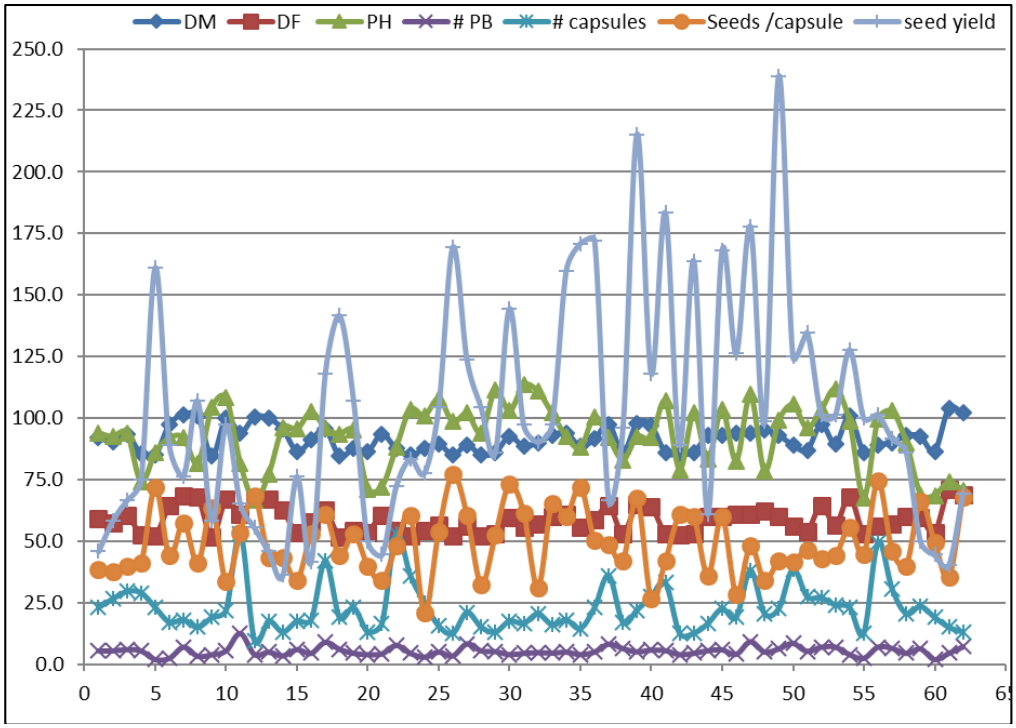

Fig 1: Genotypic variation for different characters in niger germplasm (DF- days to 50% flowering, DM- Days to maturity, PH- Plant height, #PB- Number of primary branches, # capsules - Number of capsules Seeds/capsules- number of seeds capsule^{-1}, seed yield –seed yield kgha^{-1})

Table 4: Correlation among the yield and yield attributing characters of niger germplasm

Character	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of primary branches	Number of capitula per plant	Number of Seeds per capsule	Seed yield (Kg/ha)
Days to 50% flowering	1.0000						
Days to maturity	1.0000**	1.0000					
Plant height (cm)	-0.2041	-0.2041	1.0000				
Number of primary branches	0.1480	0.1480	0.1905	1.0000			
Number of capitula per plant	-0.0527	-0.0527	0.2093	0.6759**	1.0000		
Number of Seeds per capsule	-0.0725	-0.0725	0.0531	-0.0036	-0.0150	1.0000	
Seed yield (Kg/ha)	-0.1333	-0.1333	0.3883**	0.0409	0.0551	0.2740*	1.0000

*significant at 5% and **significant at 1% level of significance.

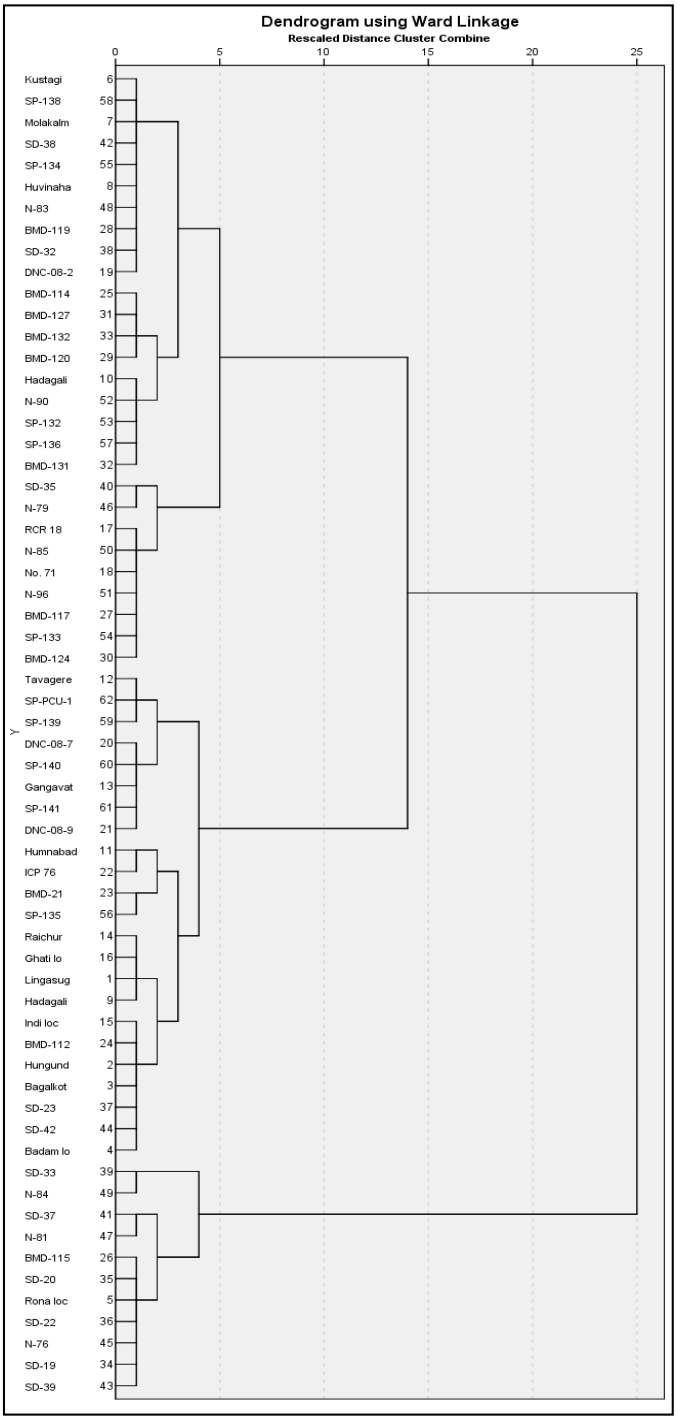

Fig 2: Dendrogram of 62 germplasm of niger

4. Conclusion

Niger is a minor oilseed crop grown in India. the germplasm was collected and evaluated which helps in identification of superior yielding genotypes. Lot of variation was observed for the characters seed yield, number of seed per capsule and plant height. Correlation studies revealed that seed yield was positively associated with plant height and number of seeds per capsule. The 62 germplasm lines were clustered into two clusters.

5. References

1. Ahmad E, Ram S, Kerketta V, Singh DN. Genetic association, heritability and genetic advance in Niger (*Guizotia abyssinica* (L.f) Cass.) Journal of Research Birsa Agriculture University. 2003; 15(2):251-254.
2. Anonymous. Sesame and niger annual report 2011-12. All India Coordinated Research Project, sesame and niger, Jabalpur. 2011, 247-250.
3. Anonymous. Sesame and niger annual report 2014-15, All India Coordinated Research Project, sesame and niger, Jabalpur. 2014, 207-214.
4. Baghel K, Salam JL, Kanwar RR, Bhanwar RR. Genetic Variability analysis of yield and its components in niger [(*Guizotia abyssinica* (L. f.) Cass.]. Int. J. Curr. Microbiol. App. Sci. 2018; 7(8):4266-4276.
5. Bisen R, Panday AK, Jain S, Sahu R. Genetic analysis in niger (*Guizotia abyssinica* Cass.) Progressive Research. 2015; 10(3):1536-1539.
6. Bisen R, Pandey AK, Jain S, Sahu R, Malviya M. Estimation of genetic divergence among the niger germplasm. The J. Animal and Plant Sci. 2016; 26(5):1320-1325.
7. Getinet A, Wold AT. An agronomic and seed quality evaluation of noug (*Guizotia abyssinica* Cass.) germplasm in Ethiopia. Plant Breeding. 2006; 114(4):375-376.
8. Jagtap PK, Sandipan PB, Patel KM, Patel MC. Interrelationship between yield and yield attributing traits in Niger germplasm. Trends in Biosciences. 2014; 7(16): 2135-2136.
9. Patil S, Bhavsar VV, Deokar S. Evaluation of Genetic Variability for Quantitative and Qualitative Characters in Niger [*Guizotia abyssinica* (L.f) Cass] Local Germplasm. Int. J. Curr. Microbiol. App. Sci. 2019; 8(08):2087-2093.
10. Patil HS, Duhoon SS. Nature of variability, association and path analysis in Niger. J. Oilseed Res. 2005; 22(2):438-449.
11. Patil HE, Mali RS, Giri AR, Thawari SB. Genetic improvement in niger (*Guizotia abyssinica* Cass.) by using study of variability, correlation and path analysis. Internl. J Agric. Sci. 2013; 9(2):671-673.
12. Sreedhar RV. Assessment of genetic variability in niger (*Guizotia abyssinica* Cass.). M.Sc. (Agri.) Thesis, University of Agricultural Science, Dharwad, 2003.
13. Suryanarayana L, Sekhar D, Tejeswara Rao K. Genetic divergence studies in niger (*Guizotia abyssinica* L.) genotypes. J. Pharmacognosy and Phytochemistry. 2018; 7(5):725-727.
14. Suryanarayana L, Sekhar D, Tejeswara Rao K. Assessment of genetic divergence in niger (*Guizotia abyssinica* L.). Internl. J. Chem. Studies. 2019; 7(3):4061-4063.
15. Vinod K, Rajani B. Genetic study for yield and yield attributing traits in niger germplasm. Internl. J. Agric. Sci. 2016; 8(56):3044-3046.
16. Vinod K, Rajani B, Assessment of genetic divergence in niger germplasm. Internl. J. Chem. Studies. 2017; 5(4):1482-1485.
17. Thakur SK, Reddy RK. Genetic variability, correlation and path analysis in niger (*Guizotia abyssinica* Cass.). J. Oilseed Res. 2012; 29(1):31-33.