AJH
eISSN- 0976-724X

THE ASIAN JOURNAL OF HORTICULTURE
Volume **13** | Issue 1 | June, 2018 | 32-35
Visit us -*www.researchjournal.co.in*

RESEARCH PAPER

DOI : 10.15740/HAS/TAJH/13.1/32-35

Article history :
Received : 26.12.2017
Revised : 15.05.2018
Accepted : 28.05.2018

Genetic variability in nigella (*Nigella sativa* L.)

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ABSTRACT : Analysis of variability carried out for ten characters in sixteen diverse genotypes of nigella (*Nigella sativa* L.) revealed high genotypic and phenotypic co-efficient of variations for secondary branches per plant, number of grains per fruit, number of fruits per plant, length of fruit (cm) and width of fruit (cm). Heritability estimates were high for number of grains per fruit (0.86), number of fruit per plant (0.78), length of fruit (0.64), days to maturity (0.59), number of secondary branches per plant (0.56) and yield per plant (0.47). Higher genetic advance as percentage of mean was recorded for number of grains per fruit (46.11%), number of secondary branches per plant (43.99%), number of fruits per plant (39.65%), yield per plant (24.49%), length of fruit (24.12%) and indicating additive gene effect. Quantitative traits like days to maturity, number of secondary branches per plant, number of grains per fruit and number of grains per fruit exhibited wide range of variability (134.33-143.00) maximum genotypic co-efficient of variability (29.53), maximum phenotypic co-efficient of variability (22.18), broad sense heritability (0.86) and gene gain (46.11).

KEY WORDS : Nigella, Genetic advance heritability, Variability

HOW TO CITE THIS ARTICLE : Singh, S.P. and Singh, S.K. (2018). Genetic variability in nigella (*Nigella sativa* L.). *Asian J. Hort.*, **13**(1) : 32-35, **DOI : 10.15740/HAS/TAJH/13.1/32-35.**

Nigella (*Nigella sativa* L.) is an important minor seed spices crop. It is commercially cultivated in Punjab, H.P., Bihar, West Bengal and Assam. It is called Karunjrangan, Kalonji, Mangarail, Kalonkir also. It is used as condiment and has medicinal value for the treatment of cough, asthma and fever. The dried seeds of nigella is commercial product. According to Ramar *et al*. (2000), nigella possess an aroma resembling strawberries when crushed. The chemical constituents found in nigella seeds are glucosidal- melanthin and melanthingenin, bitter substances and a crystalline active principle nigellone, essential oil, fixed oil, resin and tannins (Latif and Rehman, 1999). The seeds contain 1.5 and to 4.1% essential oil, which is used in food flavor and pharmaceutical industries. The seeds of nigella are being used as spice from the ancient time in preparation of pickles and puri as one of the ingredients. Nigella belong to family Ranunculaceae. The nigella plant is a small herb of 30-80cm height. Flowers solitary and terminal, beautiful due to the development of carona, sepals 5, petaloids, corolla absent, stamens numerous, carpels 5, partially united, fruit a capsule, nectarines many, generally 10, packel like- epicalyx present (Chopra, 1998). A little efforts have been made to evolve new cultivars suiting to different agro-climatic conditions. Efforts are needed in exploration of genetic resources, conservation, evaluation, cataloguing and utilization of germplasm for crop improvement. For crop improvement, the genetic variability plays an important role in a selecting the best genotypes for making rapid improvement in yield and other desirable characters as well as to select the potential parent for hybridization programmers. Heritability is an index for calculating the relative influence of environment on expression of genotypes. It becomes very different to judge how much of the variability is heritable and how much is non-heritable. Therefore, the

Table 1 : Name, source and collection year of the nigella genotypes

Sr. No.	Name of genotypes	Source of genotypes	Collection year
1.	RN-1	Samastipur, Bihar	1994
2.	RN-2	Samastipur, Bihar	1994
3.	RN-3	Samastipur, Bihar	1994
4.	RN-4	Muzaffarpur, Bihar	1995
5.	RN-5	Muzaffarpur, Bihar	1996
6.	RN-6	Vaishali, Bihar	1996
7.	RN-7	Samastipur, Bihar	1997
8.	RN-8	Vaishali, Bihar	1997
9.	RN-9	Muzaffarpur, Bihar	1997
10.	RN-10	East Champaran, Bihar	1998
11.	RN-11	East Champaran, Bihar	1998
12.	RN-12	West Champaran, Bihar	1999
13.	RN-13	Begusarai, Bihar	1999
14.	RN-14	Aurangabad, Bihar	2000
15.	RN-15	Samastipur, Bihar	2000
16.	Rajendra Shyama (Check)	Released variety	

present investigation was carried out to study the variability, heritability and genetic advance for ten important characters in nigella.

RESEARCH METHODS

The study was conducted on sixteen (16) diverse genotypes collected from different districts of Bihar. The experiment was laid out in randomized block design with three replications during *Rabi* 2016-17at Muraul experimental farm of Horticulture, T.C.A., Dholi (Dr. Rajendra Prasad Central Agricultural University, Bihar). The experiment was conducted under All India Coordinated Research Project of Spices. Each entry was grown in two rows of four meter length having line to line distance 30cm and maintained 10cm distance between plant to plant. The observations were recorded of five selected plants for ten traits *viz*., plant height (cm), number of primary branches plant^{-1}, number of secondary branches plant^{-1}, days to 50% flowering, length of fruit (cm) width of fruit (cm), days to maturity, number of fruit plant^{-1}, number of grains fruit^{-1} and seed yield plant^{-1}. The data on days to 50% flowering and maturity were recorded on plot basis while five plants were tagged at random in each genotype in two rows. The mean data were statistically analyzed for analysis of variance (Panse and Sukhatme, 1978).

The phenotypic and genotypic co-efficient of variances (PCV, GCV) and expected genetic advance (GA) were computed following Jonson *et al.* (1955).

RESEARCH FINDINGS AND DISCUSSION

The analysis of variance for all the traits showed highly significant differences among the genotypes, indicating sufficient amount of variability in the material (Table 2). A wide range of variability for different characters was also observed by Rajpus *et al.* (2004) and Yadav *et al.* (2013) in fennel and Ghanshyam *et al.* (2015) in ajwain.

The extent of variability present in sixteen genotypes of nigella was measured in term of range, mean, PCV, GCV, heritability in broad sense and genetic advance (Table 3). All the genotypes differed significantly with respect to different characters studied. Wide range of variation was observed in all characters. Dalkani *et al.* (2012) and Ghanshyam *et al.* (2015) also reported wide range of variation for most of the characters in ajwain. The GCV and PCV were higher for number of secondary plant^{-1} (22.18 and 29.53) followed by grains fruit $^{-1}$ (18.79 and 20.21), number of fruits $^{-1}$ (17.01 and 19.27), seed yield plant $^{-1}$ (13.54 and 19.76) and length of fruit (11.40 and 14.23) indicating greater variability for these traits. In general, there were narrow difference between GCV and PCV (Table 3) which indicated close association between phenotypic and genotypic variability. These results are in agreement with those reports of Rajpus *et al*. (2004), Yadav *et al*. (2013) in fennel, Ghanshyam *et al.* (2015) in ajwain and Singh and Singh (2013) in coriander.

Heritability is a parameter of tremendous

Table 1 : Mean of economically important characters of nigella

Characters	Height of the plant (cm)	No. of primary branches per plant	No. of secondary branches per plant	No. of days to 50% flowering	Length of fruit (cm)	Width of fruit (cm)	Days to maturity (No. of days)	No. of fruits per plant	No. of grains per fruit	Yield per plant (g)
V_1-RN-1	70.27	6.75	16.43	69.00	1.83	1.33	134.33	68.00	69.00	11.08
V_2- RN-2	68.03	7.17	25.27	68.33	1.88	1.46	136.33	92.67	70.00	16.63
V_3- RN-3	69.18	7.00	25.13	74.00	1.89	1.50	140.30	62.66	75.00	16.65
V_4- RN-4	63.43	7.07	28.40	76.00	1.88	1.37	139.33	71.00	87.50	10.76
V_5- RN-5	71.18	7.22	24.43	72.67	1.84	1.38	137.67	65.67	85.00	13.16
V_6- RN-6	70.75	7.50	27.67	73.00	1.82	1.52	138.00	106.60	115.00	16.85
V_7- RN-7	72.57	7.15	22.17	76.67	1.89	1.33	141.33	82.00	75.50	15.43
V_8- RN-8	69.02	7.00	21.33	75.00	2.09	1.60	142.00	70.00	83.55	13.29
V_9- RN-9	68.85	6.77	19.77	75.33	2.04	1.53	142.67	76.00	77.50	14.84
V_{10}- RN-10	70.63	7.50	24.67	73.67	1.83	1.80	142.67	70.00	100.00	14.52
V_{11}- RN-11	69.17	6.60	17.43	70.00	2.02	1.40	142.33	65.00	70.45	15.64
V_{12}- RN-12	74.15	8.42	39.50	75.00	1.88	1.45	141.66	86.00	100.40	16.48
V_{13}- RN-13	72.25	7.92	27.00	72.67	1.94	1.55	143.00	67.00	109.00	16.96
V_{14}- RN-14	67.13	7.47	22.53	75.67	1.91	1.61	143.00	74.67	101.50	14.57
V_{15}- RN-15	72.78	6.83	20.40	70.67	1.99	1.33	142.67	61.00	107.50	14.99
V_{16}- Rajendra Shyama	62.42	6.33	14.60	65.67	1.05	1.30	137.33	55.00	61.00	9.68
S.E. ±	2.27	0.33	2.15	2.13	0.09	0.08	1.19	3.83	3.75	1.20
CD (P = 0.05)	6.57	0.96	6.22	6.21	0.26	0.24	3.46	11.07	10.77	3.47
CV (%)	5.67	7.99	5.13	5.12	8.51	9.69	1.48	9.06	7.45	14.39

Table 2 : Analysis of variance for ten quantitative traits in nigella

Characters	Replication MS (2d)	Treatment MS (15)	Error MS (30)	S.E.±	C.D. (P = 0.05)	CV (%)
Height of the plant (cm)	8.82	30.25**	15.53	2.20	6.57	5.67
No. of primary branches per plant	0.43	0.79	0.33	0.32	0.96	7.99
No. of secondary branches per plant	14.11	102.90**	21.06	2.56	7.65	19.48
No. of days to 50% flowering	44.64	29.86**	13.89	2.08	6.21	5.12
Length of fruit (cm)	0.01	0.16	0.03	0.08	0.26	8.51
Width of fruit (cm)	0.0006	0.05	0.02	0.08	0.24	9.68
Days to maturity	7.58	29.93**	4.29	1.16	3.46	1.48
No. of fruits per plant	3.27	511.16**	44.09	3.71	11.07	9.05
No. of grains per fruit	7.75	838.60**	41.75	3.61	10.77	7.45
Yield per plant (g)	1.41	15.85**	1.20	1.16	3.47	14.39

* and ** indicate significance of values at P=0.05 and 0.01, respectively.

Table 3 : Genetic parameters for seed yield and its attributing character in nigella

Variance / Characters	Range	Mean	Phenotypic variance	Genotypic variance	Phenotypic co-efficient of variance	Genotypic co-efficient of variance	Heritability (%) broad sense	Genetic advance over mean
Height of the plant (cm)	62.42-74.15	69.49	4.91	20.43	3.19	6.51	0.24	4.12
No. of primary branches per plant	6.33-8.42	7.17	0.15	0.48	5.49	9.70	0.32	8.21
No. of secondary branches per plant	14.60-39.50	23.55	27.28	48.34	22.18	29.53	0.56	43.99
No. of days to 50% flowering	65.67-76.67	72.71	5.32	19.21	3.17	6.03	0.28	4.41
Length of fruit (cm)	1.05-2.09	1.86	0.05	0.07	11.40	14.23	0.64	24.12
Width of fruit (cm)	1.30-1.80	1.47	0.01	0.03	7.15	12.04	0.35	11.21
Days to maturity	134.33-143.00	140.29	6.21	10.51	1.78	2.31	0.59	3.61
No. of fruits per plant	55.00-106.67	73.33	155.69	199.78	17.01	19.27	0.78	39.65
No. of grains per fruit	61.00-115.00	86.75	265.62	307.37	18.79	20.21	0.86	46.11
Yield per plant (g)	9.68-16.96	14.47	3.84	8.17	13.54	19.76	0.47	24.49

significance to the breeders as its magnitude indicates the reliability with genotypic expression (Table 3). High heritability (broad sense) estimates were found for number of grains fruit^{-1} (0.86), number of fruits plant^{-1} (0.78), length of fruit (0.64), number of days to maturity (0.59) indicating that these characters were less influenced by the environment and direct selection for these traits would be effective for further improvement. These findings are agreement with the high heritability estimate in fennel reported by Rajpus *et al.* (2004); Yadav *et al.* (2013); Singh *et al.* (2006) and Singh and Singh (2013) in coriander and Ghanshyam *et al.* (2015) in ajwain. High heritability estimates coupled with high genetic advance in per cent of mean were recorded seed yield plant^{-1}, number of grains fruit^{-1}, number of fruits plant^{-1}, number of primary branches and secondary branches plant^{-1}, length and width of the fruit and height of the plant indicating the predominance of additive gene action for these characters. The result suggested that the characters showing high heritability estimates coupled with high genetic advance in per cent of mean can be easily improved by careful selection.

Johnson *et al.* (1955) and Burton and De Vene (1953) suggested that heritability together with genetic advance is a most useful parameter in choice of the best genotype by selection. Yadav *et al.* (2013) reported high heritability with moderate to high genetic advance for majority of characters in fennel. Singh *et al.* (2006) and Singh and Singh (2013) reported different genetic parameters for seed yield and is components in coriander and their finding support the present investigation. Dashora (2015) studied on the assessment of genetic variability, co-relation and path analysis on ajwain.

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