"Genetic variability of Black cumin (*Nigella sativa* L.)" under climatic condition of Prayagraj

Abstract

An Experiment on Black cumin was conducted during September to March 2023-2024, in horticulture Research field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, and Technology & Sciences Prayagraj(UP) India. The results of the investigation, regarding the performance of the 7 variety of black cumin *i.e.* NS-44, NS-32, Ajmer Nigella-1, Ajmer Nigella-20, Azad kalonji, Local variety -1, Local variety- 2 obtained from different sources to find out the best performance in terms of growth and yield in Prayagraj agro-climatic conditions. The experiment was conducted in Randomized Block design, were each variety replicated thrice the results from the present investigation concluded that black cumin genotype Azad kalonji was recorded with maximum number of flowers/plant (78.33), Seed/ capsule (93.67), Seed yield (1.85 t/ha) and with maximum gross return, net return and cost Benefit Ratio of (3.75) which was found to be more productive and economically viable.

Keywords:*Black cumin,Varieties,Agro-Climatic Condition.*

1. INTRODUCTION:

Black cumin (*Nigella sativa L.*) is an annual spice crop belonging to family Ranunculaceae, diploid species with 2n =12. It is also called kalonji and a main spice crop in India. Black cumin mostly grown in cold and dry regions with a temperature range of 5-25°C with optimum of 12-14 °C and rainfall of 400-500 mm are most suitable climatic condition for its proper growth and yield. Black cumin grown in all type of soil but loamy sand soil is best. It can be grown from sea level to 2500 meter above sea level, with yields decreasing as altitude rises.

The World Health Organization emphasizes the research of medicinal plants due to its positive effects on human health. Scientific studies on aromatic plants emphasize quality assurance, quality control, safety, activity, species toxicity, dosage, clinical trials, therapeutic applications, and drug interactions.

The black cumin family is one of the most important plants for volatile and fixed oil. The Ranunculaceae family of plants is a Mediterranean herbaceous plant. Scientific information, such as safety, efficacy, quality control/quality assurance, dose, toxicity description of plant species, medicinal uses, clinical trials, and drug interactions, have all been prioritized.**(Chhiroliya et al., 2023; Akash Krishnan et al., 2022; Ozer, 2020).**

Black cumin an annual oilseed and medicinal crop native to the Mediterranean region and a member of the Ranunculaceae family is well-known for its therapeutic properties. Different nations, including Syria, India, South Europe, Saudi Arabia, Turkey, and Pakistan cultivate this crop **(Datta et al. 2012)**. Short-lived annual Black cumin grows in normal soils and is a part of a semiarid natural community where therophytes predominate **(Kara et al. 2015)**.

The dry nigella seed is a commercial product that is used in food. The seed contains 0.5 to 1.4 percent essential oil, which is sought after in the pharmaceutical and fragrance industries. The yield (raw plant product-seeds; bioactive compounds-essential oil) and quality of black cumin

will have a big impact on its medicinal and commercial potential. The seed and oil yields of black cumin have recently received a lot of attention. The seed of black cumin used for pickle making, cooked vegetable preparation and other cuisines. [23-25]

It will be grown on an estimated 16000 hectares with an output of 6250 tones. The majority of farmers grow indigenous varieties because to a lack of better cultivars.

Variety selection depends primarily on its adaptation to the soil and climate conditions and preferably on their having resistancetolerance to pests and diseases. There are many varieties released for cultivation in different areas. The description of some of the important cultivated varieties is given as under: Ajmer Nigella-1 It is developed by ICAR-National Research Centre on Seed Spices, Ajmer. It is suitable for cultivation in semi-arid region under irrigated conditions. The plants are 30-35 cm in height. This variety takes 135 days to reach seed maturity and has resistance to root rot. The ovary is pentamerous and each capsule contains 65 seeds. The seeds of this variety contain about 0.3 percent of essential oil.

The average seed yield of Ajmer Nigella-1 is 800kg/ha. Ajmer Nigella-20 It is developed by ICAR-National Research Centre on Seed Spices, Ajmer through mass selection. This variety matures in 140-150 days. It is suitable for all parts of Rajasthan. Average yield of this variety is 10-12 q/ha. Suitable sowing time determined is 15-30 October. This variety contains28 percent total oil and 0.3 percent essential oil. Azad Kalonji This variety developed at Chandra ShekharAzad University of Agriculture and Technology, Regional Research Station, Kalyanpur, Kanpur. It takes about 135-145 days to produce seed. Average seed yield of this variety is 900-1000 kg/ha. NS-44 This variety is developed by Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh. It yields 4.5 to 6.5 q/ha and matures in 140-150 days. NS-32 This is also cultivar produces 4.5-5.5 q/ha. seed and matures in 140-150 days. It was development by Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh. Kalajeera variety of Nigella takes 135-145 days to produce seed. Average seed yield is 400-500kg/ha.

2. MATERIALS & METHODS:

i. Experimental Site and Location: The experiment was conducted during rabi season of the year 2023–24 at Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj. The experimental site is located in the sub–tropical region which is located at 35^0. 32^1 N latitude, 94^0. 65^1 E longitude and 98 m above the mean sea level.

ii. Climate Condition: Area of Prayagraj district comes under subtropical belt in the south east of Uttar Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46 ºC – 48 ºC and seldom falls as low as 4ºC – 5ºC. The relative humidity ranges between 20 to 94 %. The average rainfalls in this area are around 1013.4 mm annually.

Table.1 Detailsofvariety

Numberof Varieties	NameofVarieties	Sources
V_1	NS-44	JNKVV,Jabalpur
V_2	NS-32	JNKVV,Jabalpur
V_3	AjmerNigella-1	NRCSS,Ajmer
V_4	AjmerNigella-20	NRCSS,Ajmer
V_5	AzadKalonji	CSAUniversityofagriculture,Kanpur
V_6	Localvariety-1	UttarPradesh
V_7	Localvariety-2	UttarPradesh

2.1 Statistical analysis the statistical analysis of the data was carried out using STATISTICA (7.0) software.

3. RESULTS & DISCUSSION

The present investigation entitled "Genetic variability of Black cumin (*Nigella sativa L.)*" were carried out at Horticulture Research Farm, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.). in the year 2023-24. The results of the investigation, regarding the Black cumin on growth and yield have been presented in table and bar – diagrams wherever required. The result of the experiment has been presented under the following heading.

- **Days to germination**
  Days to germination in different variety of Black cumin was recorded, statistically as presented in Table 2. The result recorded that the minimum Days to Germination was found in V_6 (Local-1) variety that is 12.00 days, followed by the V_5 (Azad kalonji) 13.33 days and maximum number of days to germination was recorded in the Variety V_4 (Ajmer Nigella-20) 15.67 days.
- **Plant Height (cm)**
  The significant variation in plant height in different variety of Black cumin was recorded, statistically as presented in Table 2. The maximum Plant Height was found in V_5 (Azad kalonji) variety that is 79.63 cm Followed by the variety V_4 (AN-20) variety 69.03 cm, and minimum plant height at was recorded in the variety V_1 (NS-44) 46.06 cm.
- **Number of Primary & Secondary Branches/Plant**
  Number of Primary Branches / Plant in different variety of Black cumin was recorded, statistically as presented in Table 2. The result recorded that, the maximum Number of Primary Branches/Plant was found in V_5(Azad kalonji) variety that is 9.87 followed by the V_7 (Local-2) variety 7.67 and Number of Primary Branches / Plant was recorded in the variety V_1 (NS-44) 6.00.
  The result recorded that, the maximum Number of Secondary Branches/Plant was found in V_5(Azad kalonji) variety that is 12.67 followed by the V_7 (Local-

2) variety 9.67 and Number of Primary Branches / Plant was recorded in the variety V_1 (NS-44) 8.33.

- **Day of Maturity**
  Day of Maturity in different variety of Black cumin was recorded, statistically as presented in Table 3. The result recorded that, the maximum Days of maturity was found in V_5 (Azad kalonji) variety that is 180.67 days, followed by the V_3 (AN-1) 160.33 days and minimum number of Days of maturity was recorded in the Variety V_1 (NS-44) 157.67 days.
- **Day to First Flowering**
  Day to First Flowering in different variety of Black cumin was recorded, statistically as presented in Table 3. The result recorded that the minimum Day to First Flowering was found in V_1 (NS-44) variety that is 91.33 days, followed by the V_2 (NS-32) 97.00 days and maximum Day to First Flowering was recorded in the Variety V_5 (Azad kalonji) 103.33 days.
- **Day to 50% Flowering**
  Day to 50% Flowering in different variety of Black cumin was recorded, statistically as presented in Table 3. The result recorded that, the minimum Day to 50% Flowering was found in V_1 (Ns-44) variety that is 110.33 days, followed by the V_2 (NS-32) 115.67 days and maximum Day to 50% Flowering was recorded in the Variety V_5 (Azad kalonji) 119.67 days.
- **Number of Flowers/Plant**
  Number of Flowers / Plant in different variety of Black cumin was recorded, statistically as presented in Table 3.The result recorded that, the maximum Number of Flowers/Plant was found in V_5 (Azad kalonji) variety that is 78.33 followed by the V_4 (AN-20) variety 69.53 and minimum Number of Flowers/Plant was recorded in the variety V_1 (NS-44) 62.33.
- **Seeds / Capsule**
  Seeds / Umbel in different variety of Black cumin was recorded, statistically as presented in Table 3. The result recorded that, the maximum Seeds / Capsule was found in V_5 (Azad kalonji) variety that is 95.67 followed by the V_4 (AN-20) variety 72.67 and minimum Seeds / Capsule was recorded in the variety V_1 (NS-44) 62.33.
- **Seeds Yield t/ha**
  Seeds Yield /Plant in different variety of Black cumin was recorded, statistically as presented in Table 3. The result recorded that, the maximum Seeds Yield t/ha was found in V_5 (Azad kalonji) variety that is 1.85 t/ha followed by the V_6 (Local-2) variety 1.33 t/ha and minimum Seeds Yield t/ha was recorded in the variety V_1 (NS-44) 0.85 t/ha.
- **Test Weight (g)**
  Test Weight in different variety of Black cumin was recorded, statistically as presented in Table 3. The result recorded that, the maximum Test Weight was found in V_5 (Azad kalonji) variety that is 2.68 g followed by the V_6 (Local-1) variety 2.34 g and minimum Test Weight was recorded in the variety V_2 (NS-32) 2.08 g.

Table 2. Performance of Black Cumin (*Nigella sativa l.*) in the terms of Days of Germination, Plant height (cm), Primary & Secondary Branches/Plant

S. No.	Varieties	Days of Germination	Plant height (cm)				Primary Branches/Plant	Secondary Branches/Plant
			30 DAS	60 DAS	90 DAS	120 DAS		
1.	NS-44	12.33	5.81	11.34	23.96	46.06	5.33	8.33
2.	NS-32	14.33	7.89	12.82	27.19	48.41	5.67	9.67
3.	Ajmer Nigella-1(AN-1)	12.00	8.20	14.52	36.35	55.77	6.33	8.67
4.	Ajmer Nigella-20(AN-20)	15.67	8.68	17.50	38.55	69.03	7.33	10.00
5.	Azad Kalonji	13.33	11.39	22.48	59.03	79.63	9.00	12.67
6.	Local variety -1	12.00	7.31	15.18	28.62	59.44	7.33	10.33
7.	Local variety -2	13.67	8.13	19.18	44.42	66.36	7.00	9.67
	F -test	**S**	**S**	**S**	**S**	**S**	**S**	**S**
	C.D. (5%)	**1.33**	**1.16**	**1.76**	**3.65**	**2.59**	**1.19**	**1.83**
	S.E.(d)(±)	**0.61**	**0.53**	**0.81**	**1.68**	**1.19**	**0.54**	**0.84**
	C.V.	**5.59**	**7.96**	**6.13**	**5.57**	**2.40**	**9.72**	**10.41**

Table 3. Performance of Black Cumin (*Nigella sativa l.*) in the terms of Day of Maturity, Day to First Flowering, Day to 50% Flowering, Number of Flowers/Plant, Seeds/Capsule, Seeds Yield t/ha, Test Weight (g)

S. No.	Varieties	Day of Maturity	Day to First Flowering	Day to 50% Flowering	Number of Flowers/Plant	Seeds / Capsule	Seeds Yield t/ha	Test Weight (g)
1.	NS-44	157.67	91.33	110.33	62.33	68.00	0.85	2.22
2.	NS-32	175.67	97.00	115.67	74.00	80.33	1.12	2.08
3.	AN-1	167.33	101.33	117.33	66.67	75.33	1.53	2.16
4.	AN-20	170.33	103.33	115.00	72.67	81.33	1.69	2.30
5.	Azad Kalonji	180.67	103.00	119.67	78.33	93.67	1.85	2.68
6.	Local variety -1	164.00	95.33	117.00	73.33	80.00	1.33	2.34
7.	Local variety -2	163.00	95.33	116.00	75.00	86.00	1.18	2.51
	F -test	**S**	**S**	**S**	**S**	**S**	**S**	**S**
	C.D. (5%)	**4.26**	**6.98**	**4.46**	**6.27**	**3.38**	**0.07**	**0.22**
	S.E.(d)(±)	**1.96**	**3.20**	**2.13**	**2.88**	**1.55**	**0.03**	**0.10**
	C.V.	**1.42**	**5.09**	**2.25**	**4.91**	**2.36**	**2.81**	**5.25**

CONCLUTION

The result from the present investigation it is concluded that Azad kalonji performed best in terms of Plant height (79.63 cm), Number of Primary branch (9.87), Number of Secondary branch (12.67), Number of Flowers/Plant (78.33), Number of Seeds/Capsule (93.67) and Seeds Yield (1.85 t/ha). Highest B:C was also found in Azad kalonji with 3.75.

REFERENCES:

1. **Fufa, M., (2016)** Correlation Studies in Yield and Some Yield Components of Black Cumin (*Nigella sativa L.*) Landraces Evaluated at Southeastern Ethiopia. 4: 239. 10.4172/2329-8863.1000239.
2. **Gezahegn, Assefa., Sintayehu, Girma., (2016)** Evaluation and Selection of Black Cumin (*Nigella sativa L.*) Varieties at Mid Highland of West Hararghe Zone, Eastern Ethiopia Journal of Biology, Agriculture and Healthcare 58(2): 610-962.
3. **Haq, M.Z., Hossain, M.M., Haque, M.M., Das, M.R. and Huda, M.S. (2015)** Blossoming characteristics in black cumin genotypes in relation seed yield influenced by sowing time, 6: 1167-1183.
4. **Luchon, S., and Sarat,S., (2003)** Black cumin (*Nigella sativa*) a new aromatic spicy medicinal plants. Proc. National Seminar on New perspectives in spices, medicinal and aromatic planta, ICAR Research Complex, Goa, India, November, 27-29, 2003 (pp. 153) 49(3): 208-541.
5. **Malhotra,S.K., Vashishtha, B.B., (2008)** Responce of Nigella Variety NRCSS AN I to Different Agrotechnique National Research Centre on Seed Spices, Ajmer – 305 206 Rajasthan, India 62(4): 257-328.
6. **Maryam, Sadat Salamati., Mohammad, Bag.heri., (2014)** The Study of the Relationship between Seed Yield and Yield Components on Nigella sativa Genotypes. Vol. 9/1: 2 (2014), pp: 97-103.
7. **Miberetu, Fufa., (2016)** Correlation Study in Yield and Some Yield Components of Black Cumin (*Nigella sativa L.*) Landraces Evaluation at Southeastern Ethiopia 34(6): 911-584
8. **Muhammed, Sajjad., Abdul, Ghafoor., (2010)** Evaluation of Nigella sativa 1., for Genetic Variation and Ex-situ Conservation 42:2489-249.
9. **Singh.S.P., Avinash, Kumar., Banishidhar., Sandeep, Kumar., Suman., Ashutosh, Kumar., Singh,P.P., (2019)** Assessment of genetic Diversity in Nigella (*Nigella*

sativa L.) collections using principle component analysis Dr. Rajendra prasad central agriculture university, pusa, sumastipur, bihar (848125) 5(1): 73-86.

10. **Singh, S.P., Singh, S.P., (2018).** Genetic Variability in Nigella (*Nigella sativa L.*) 10.15740/HAS/TAJH/13.1/32-35.
11. **Sen, A., Khade,S.D., Jana, J., and Choudhury, P., (2019)** Effect of integrated nutrient management on growth, yield and quality attributes of black cumin(*Nigella sativa L.*) var. Rajendra Shyama grown under terai region of West Bengal 28 (1) 61-65 (2019).
12. **Tigist, Firew., and Awlachew., (2017)** Performance Evaluation of black cumin (*Nigella sativa L.*) Varieties at Alem Ketema site, North Shewa, Ethiopia 10.3390/nu13061784.
13. **Ved, Kant., Meena., S.S., Meena., N.K., and Lal, G., (2018)** Influence of Different Dates of Sowing, Fertilizer Level and Weedicides on Growth and Yield of Nigella (*Nigella sativa L.*) under Semi-Arid Conditions. 7(9): 1156-1167.
14. **Preeti, Verma., R,K.Solanki., Abhay, Dashora., and Kakani., (2019)** Genetic Variability and Correlation Analysis in (*Nigella sativa L.*) Assessed in south East Rajasthan, india. (2019) 8(3): 1858-1864.
15. **Akgul, A. 1989.** Antimicrobial activity of black cumin (Nigella sativa L.) essential oil. Gazi Universitesi Eczacilik Fakultesi Dergisi., 6(1): 63-68.
16. **Mahto, J.L.. and S.N. Singh, 1996.** Genetic diversity and stahility in linseed. Gujarat-Agric. ini. Res. J., 22(1): 14-18. Ragazinskiene, O., S. Rimkiene, E. Seinauskiene and K. Obelevicius. 2002. Evaluation of biological-pharmacognostical properties of accessions of medicinal plant species and varieties,
17. **Biologiji., 4: 62-65. Saxena, A.P. and K.M. Vyas. 1986.** Antimicrobial activity of seeds of some ethnomedicinal plants. J. Econ. Taxon. Bot., 8(2): 291-300
18. **Nigella sativa. Egyptian J. Agri. Res., 76 (3): 1145-1156. Tayyaba, S., A. Ghafoor and M. Ashraf. 2005.** Genetic divergence in lentil germplasm for botanical descriptors in relation with geographic origin. Pak. J. Bol., 37(1): 61-69.
19. **Ahmad, Z.. A. Ghafoor and M. Aslam 2004.** Nigella sativa-a potential commodity in crop diversification traditionally used in healthcare. Introduction of Medicinal Herbs and Spices as Crops. Ministry of Food, Agriculture and Livestock, Pakistan., 1-34.
20. **Chhiroliya , J. K., Morya , R., Morya , R., Bhargava , A., & Gupta , P. K. (2023).** Effect of Plant Growth Regulators and Bio-Fertilizer on Growth and Quality of

Fenugreek (Trigonella foenum-graecum L.). International Journal of Plant & Soil Science, 35(21), 912–920. https://doi.org/10.9734/ijpss/2023/v35i214061

21. **Akash Krishnan, P. T., Singh, D., Singh, V., & Bahadur, V. (2022).** Varietal Evaluation of Black Cumin (Nigella sativa L.) in Prayagraj Agro-Climatic Conditions. International Journal of Environment and Climate Change, 12(11), 1603–1609. https://doi.org/10.9734/ijecc/2022/v12i1131142
22. **Ozer H, Coban F, Sahin U, Ors S.** Response of black cumin (Nigella sativa L.) to deficit irrigation in a semi-arid region: Growth, yield, quality, and water productivity. Industrial crops and products. 2020 Feb 1;144:112048.
23. Chhiroliya , J. K., Morya , R., Morya , R., Bhargava , A., & Gupta , P. K. (2023). Effect of Plant Growth Regulators and Bio-Fertilizer on Growth and Quality of Fenugreek (Trigonella foenum-graecum L.). International Journal of Plant & Soil Science, 35(21), 912–920. https://doi.org/10.9734/ijpss/2023/v35i214061
24. Akash Krishnan, P. T., Singh, D., Singh, V., & Bahadur, V. (2022). Varietal Evaluation of Black Cumin (Nigella sativa L.) in Prayagraj Agro-Climatic Conditions. International Journal of Environment and Climate Change, 12(11), 1603–1609. https://doi.org/10.9734/ijecc/2022/v12i1131142
25. Ozer H, Coban F, Sahin U, Ors S. Response of black cumin (Nigella sativa L.) to deficit irrigation in a semi-arid region: Growth, yield, quality, and water productivity. Industrial crops and products. 2020 Feb 1;144:112048.