

## GENETIC VARIABILITY STUDIES IN KHEDA *AMARANTHUS DUBIUS* MART. GENOTYPES COLLECTED FROM CHHATTISGARH

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**Abstract:** Twenty five genotypes of Kheda *Amaranthus dubius* Mart. collected from different agroclimatic region of Chhattisgarh were evaluated to assess the genetic variability, heritability and genetic advance for thirteen different yield contributing characters and important quality characters for yield traits. Significant genetic variation was observed for all the characters. High magnitude of genotypic as well as phenotypic coefficient of variations were recorded for traits viz., test weight of seed (30.83 and 30.96), plant height (29.22 and 29.57), leaf length (28.13 and 28.48) and yield kg per plot (28 and 29.28). The highest heritability was recorded for the characters viz., test weight of seed (99.10 %), plant height (97.70 %), leaf length (97.6 %), dry matter % (96.7 %), leaf width (95.0 %), number of branches per plant (91.6 %), yield kg/plot (91. %), petiole length (91.2). Genetic advance as percentage of mean was observed high for test weight of seed (63.44%), plant height (59.48 %), leaf length (57.21 %), yield kg/plot (55.27 %), leaf width (52.34 %), number of branches per plant (51.14%), dry matter% (49.29%), number of leaf per plant (44.52 %), petiole length (43.83 %), fibre content % (30.81 %), showing the possibility of improvement of these traits through selection.

**Keywords:** Variability, GCV, PCV, Heritability, Genetic advance, Khedha (*Amaranthus dubius* Mart.)

### INTRODUCTION

Khedha (*Amaranthus dubius* Mart.) is one of the unexploited and underutilized leafy vegetable also known as Khedha bhaji and *jari bhaji* in Chhattisgarh belongs to the family amaranthaceae and one of the common leafy vegetable of the state. It is a rich and inexpensive source of carotenoid, protein, vitamins and dietary fibre (Prakash and Pal, 1991; Shukla *et al.*, 2003). Amaranth uses the C<sub>4</sub> cycle photosynthetic pathway. It has a high rate of photosynthesis and excellent water use efficiency at high temperatures and high radiation intensity. Chhattisgarh state has very rich in leafy vegetable like Chench (*Corchorus acutangulus* Lam.) and *Amaranthus* genotypes for various traits like plant habit, branching habit, stem pigmentation, leaf venation, seed colour, petiole colour, leaf characters, viz., shape, size, etc. (Kurrey *et al.*, 2015). Chhattisgarh region. Leafy vegetables play a major role in nutritional requirement of the tribal and local population in remote parts of the Chhattisgarh. Leafy vegetable not only provide food quantity but also make significant contribution to the population nutrition throughout the year (Chauhan *et al.*, 2014). Traditionally, genetic diversity studies are based on differences in morphological characters and qualitative traits. It has been used as a powerful tool in the classification of cultivars and also to study taxonomic status. (Kurrey *et al.*, 2015) Genetic variability is essentially the first step of plant breeding for crop improvement which is immediately available for germplasm which is considered as the reservoir of variability for different characters (Vavilov, 1951). Phenotypic and genotypic

coefficients of variation are useful in detecting amounts of variability present in germplasm. Heritability and genetic advance help in determining the influence of environment in expression of characters and the extent to which improvement is possible after selection (Robinson *et al.*, 1949). Heritable variation can be effectively studied in conjunction with genetic advance. High heritability alone is not enough to make efficient selection in segregating generation and needs to be accompanied by a substantial amount of genetic advance (Johanson *et al.*, 1955). Therefore, selection for desirable types should not only be restricted to yield alone but other components related to yield should also be considered (Varalakshmi and Reddy, 1997). So there is an urgent need of information on the nature and magnitude of variation available in the material and part played by environment in expression of different characters. Keeping in view the above facts, the present investigation was undertaken to estimate the magnitude of heritable and non heritable component of variation and genetic parameters such as genotypic coefficient of variation, phenotypic coefficient of variation heritability and genetic advance in 25 diverse genotypes of Khedha (*Amaranthus dubius* Mart.).

### MATERIAL AND METHOD

The experimental material for the study comprised of 25 genotypes collected from three agro climatic zones of Chhattisgarh and laid in randomized complete block design (RCBD) with three replications at the Horticultural Instructional and Research Farm, Department of Horticulture, Indira

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Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) lies between 21°16' N latitude and 81°36' E longitude with an altitude of 289.56 meters above the mean sea level. The experiment was conducted during Rabi season 2014-15. The soil properties like organic carbon (%) 0.60, Available N (kg ha<sup>-1</sup>) 275.00, Available P (kg ha<sup>-1</sup>) 16.75 and Available K (kg ha<sup>-1</sup>) 303.00 Soil Reaction pH 7.09 and Electrical conductivity (n mh cm<sup>-1</sup>) 0.19 was observed in the site of experiment. The seeds were sown in 20cm apart between rows and 15cm within the row. Standard agronomic practices and plant protection measures were taken as per schedule. Test weight was recorded before sowing of crop. Observations were recorded on five randomly selected plants per replication plant height (cm), number of leaf per plant, leaf length (cm), leaf width (cm), petiole length (cm), number of branches per plant, dry matter %, root length (cm), days of 50% flowering, fibre content %, test weight of seed (g), yield (q/ha). , were recorded at 60 days after sowing while days to 50% flowering, duration of crop were recorded periodically. Data were analyzed as per Panse and Sukhatme (1984) for analysis of variance. Phenotypic and genotypic coefficients of variation (PCV and GCV), heritability in broad-sense and genetic advance as percent of mean were calculated as per procedures given by Burton and De Vane (1953) and Johnson *et al.* (1955).

## RESULT AND DISCUSSION

The extent of variability present in the genotypes were measured in terms of ranges, phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability in broad sense and Genetic advance as percentage of mean is presented in Table 1. The analysis of variance revealed highly significant differences for all the characters studied which indicates the genotypes differ significantly for all the characters. Wide range of variation was observed in all the characters. Genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) are categorized as low (less than 10%), Moderate (10-20%) and high (more than 20%) as suggested by Sivasubramanian and Madhavamenon (1973).

High magnitude of genotypic as well as phenotypic coefficient of variations were recorded for traits viz., test weight of seed (30.83 and 30.96), plant height (29.22 and 29.57), leaf length (28.13 and 28.48), yield kg per plot (28 and 29.28), number of branches per plant (25.93 and 27.10), leaf width (25.67 and 26.33), dry matter% (24.35 and 35.77), number of leaf per plant (22.93 and 24.33), petiole length (22.24 and 23.29), suggested the substantial improvement on khedha through selection for these traits. Moderate GCV and PCV were recorded for Root length (16.78 and 20.32), Fibre content % (16.16 and 17.44), days of 50% flowering (13.57 and

14.39). Character like duration (9.27 and 12.35) had low had low genotypic and phenotypic coefficient of variation.

These results are in general agreement with the findings of Anuja and Mohideen (2007), who observed high GCV and PCV for number of leaves, yield of green, root weight, leaf weight, stem weight, and leaf area. Similar results also reported by Pan *et al.* (2008) for leaf stem ratio followed by total yield of greens/plot, girth of stem and length of leaf. Ahammed *et al.* (2012) for primary branches per plant. Sarker *et al.* (2014) for foliage yield, leaves/plant, plant height.

Phenotypic coefficient of variation (PCV) was higher than the genotypic coefficient of variation (GCV) for all the traits indicating that environmental factors were influencing their expression. Wide difference between phenotypic and genotypic coefficient of variations indicated their sensitiveness to environmental fluctuations whereas narrow difference showed less environmental interference on the expression of these traits. The traits which showed high phenotypic and genotypic coefficient of variations are of economic importance and there is scope for improvement of these traits through selection.

Heritability estimate along genetic advance are normally more useful in predicting the gain under selection than that of heritability alone. However, it is not necessary that a character showing high heritability will also exhibit high genetic advance (Johnson *et al.* 1955). An attempt has been made in present investigation to estimate heritability in broad sense and categorized as low (<50%), moderate (50%-70%) and high (>70%) as suggested by Robinson (1966).

In the present investigation high magnitude of heritability was recorded for most of characters. The highest heritability was recorded for the characters viz., test weight of seed (99.10 %), plant height (97.70 %), leaf length (97.6%), dry matter % (96.7 %), leaf width (95.0%), number of branches per plant (91.6 %), yield kg/plot (91. %), petiole length (91.2), days of 50 % flowering (89.0 %), number of leaf per plant (88.8 %), fibre content % (85.9 %). Similar results reported by Revanappa and Madalgeri (1998) for green yield per plant, plant height, number of branches per plant, number of leaf per plant. Shukla *et al.* (2006) for plant height, number of branches per plant, number of leaf per plant, foliage yield per plant. Pan *et al.* (2008) for length of leaf, width of leaf. Sarker *et al.* (2014) for plant height, number of leaf per plant, fibre content %. Moderate heritability was observed for root length (68.1 %), and duration of crop (56.3 %).

The magnitude of genetic advance as percentage of mean easy categorized as high (>20 %), moderate (20-10%) and low (<10 %) as suggested by Johnson *et al.* (1955). Genetic advance as percentage of mean was observed high for test weight of seed (63.44 %),

plant height (59.48 %), leaf length (57.21 %), yield kg/plot (55.27 %), leaf width (52.34 %), number of branches per plant (51.14 %), dry matter% (49.29 %), number of leaf per plant (44.52 %), petiole length (43.83 %), fibre content % (30.81 %), root length (28.56 %), days of 50 % flowering (26.37 %) and moderate for duration (14.31 %).

Heritability estimates along with genetic advance are more useful than the heritability value alone for selecting the best individual. High heritability coupled with high genetic advance was observed for test weight of seed, plant height, leaf length, number of leaf per plant, leaf width, petiole length, number

of branches per plant, dry matter percent, days of 50% flowering, yield kg per plot, fiber content % Indicating that most likely the heritability is due to additive gene effects and selection may be effective. Therefore, selection based on phenotypic performance of these traits would be effective to select desirable plant type. Similar results were also reported by Rani *et al.* (2003) for green yield per plant, leaf weight, plant height, leaf length, leaf breadth. Anuja and Mohideen (2007) for number of leaves, root length, root weight, leaf weight and stem weight. Hasan *et al.* (2013) for number of leaf per plant, leaf weight and marketable yield.

**Table 1.** Genetic parameter of variability for leaf yield and its component characters in Khedha (*Amaranthus dubius* Mart.)

S.No.	Characters	Mean	Range		Coefficient of Variation (%)		Heritability (h <sup>2</sup> %)	GA as percent of mean
			min	max	GCV	PCV		
01.	Plant height (cm)	30.83	18.62	48.16	29.22	29.57	97.7	59.48
02.	Number of leaf per plant	34.36	22.20	56.67	22.93	24.33	88.8	44.52
03.	Leaf length (cm)	5.68	2.19	7.61	28.13	28.48	97.6	57.21
04.	Leaf width (cm)	3.69	1.50	5.20	25.67	26.33	95.0	52.34
05.	Petiole length (cm)	3.49	1.63	5.02	22.24	23.29	91.2	43.83
06.	Number of branches per plant	5.24	3.03	10.82	25.93	27.10	91.6	52.34
07.	Root length (cm)	13.06	8.34	16.35	16.78	20.32	68.1	28.56
08.	Test weight of seed (g)	0.94	0.61	1.43	30.83	30.96	99.1	63.44
09.	Dry matter %	19.92	14.94	38.38	24.35	24.77	96.7	49.29
10.	Days of 50% flowering	55.35	34.00	65.33	13.57	14.39	89.0	26.37
11.	Yield (q/ha)	58.92	11.68	119.4	28.00	29.28	91.4	55.27
12.	Fiber content %	10.45	5.81	13.78	16.16	17.44	85.9	30.81
13.	Duration	31.51	25.33	41.67	9.27	12.35	56.3	14.31

Relationship of heritability and genetic advance also give an idea about the type of gene action. Both additive and non additive gene actions were found predominant for all the characters which suggest that the simple selection methods alone will not be effective hence hybridization followed by selection would be a better choice for amaranthus improvement (Rana *et al.* 2005). High heritability with high genetic advance could be considered reliable tools for selection. Rest of the traits showed moderate to low heritability estimates coupled with moderate to low genetic advance as percentage mean indicated the role of non additive genetic variance in their expression.

## REFERENCES

- Ahammed, A.U., Rahman, M.M. and Mian, M.A.K. (2012). Genetic variability, heritability and correlation in stem amaranth (*Amaranthus tricolor*). Bangladesh J. Pl. Breed. Genet., **25(2)**: 25-32.
- Anuja, S. and Mohideen, M. (2007). Variability, heritability and genetic advance studies in amaranthus (*Amaranthus* spp.). The Asian Journal of Horticulture, **2(1)**: 63-66.
- Burton, G. W. and Devane, E. H. (1953). Estimation of heritability in tall fescue from replicated clonal material. Agron. J. 45: 478-87.
- Chauhan, D., Shrivastava, A.K. and Patra, S. (2014). Diversity of leafy vegetables used by tribal peoples of Chhattisgarh, India. Int. J. Curr. Microbiol. App. Sci, **3(4)**: 611-622.

- Hasan, M., Akther, C.A. and Raihan, M.S.** (2013). Genetic Variability Correlation and Path Analysis in Stem Amaranth (*Amaranthus tricolor* L.) Genotypes. *The Agriculturists*, **11(1)**: 1-7.
- Johanson, H.W., Robinson, H. F. and Comstock, R. E.** (1955). Estimates of genetic and environmental variability of soybean. *Agron. J.*, **47**: 314-318.
- Kurrey, V.K., Sharma P.K., Dixit A. and Ramteke, V.** (2015). Estimation of genetic divergence among chench (*Corchorus acutangulus* Lam.) Genotypes. *The Ecoscan, Special issue*, **8**: 319-323.
- Kurrey, V.K., Sharma P.K., Dixit A.** (2015). Evaluation of Chench (*Corchorus acutangulus* Lam.) Genotypes for Various Horticultural Traits. *Trends in Biosciences* **8(22)**:6088-6091.
- Pan, R.S., Singh, A.K., Kumar, S. and Rai, M.** (2008). Genetic variation and character association in vegetable amaranth (*Amaranthus tricolor*). *Vegetable Science*, **35(1)**: 81-83.
- Panse, V. G. and Sukhatme, P. V.** (1967). *Statistical Method of Agricultural Worker*. ICAR, New Delhi. p. 381.
- Prakash, D. and Pal, M.** (1991). Nutritional and anti nutritional composition of vegetable and grain amaranth leaves. *Journal of Science of Food and Agriculture*, **57**: 573-583.
- Rana, J.C., Yadav, S.K., Mandal, S. and Yadav, S.** (2005). Genetic divergence and interrelationship analysis in grain amaranth (*Amaranthus hypochondriacus*) germplasm. *Indian J. Genet*, **65(2)**: 99-102.
- Rani, A.R.B., Veeraragavathatham, D.** (2003). Genetic variability for green yield in amaranthus. *South Indian Horticulture*, **51(1/6)**: 173-175.
- Revanappa and Madalageri, B.B.** (1998). Genetic variability studies regarding quantitative traits in Amaranthus. *Karnataka Journal of Agricultural Science*, **11**: 139-142.
- Robinson, H. F., Comstock, R. E. and Harvey, P. H.** (1949). Estimates of heritability and degree of dominance in corn. *Agron. J.* **41**: 253- 259.
- Robinson, H.F.** (1966). Quantitative genetics in relation to breeding on central of mendalism. *Ind. J .Genet*, **26( A)**: 171-187.
- Sarker, U., Islam, T., Rabbani, G. and Oba, S.** (2014). Genotypic variability for nutrient, antioxidant, yield and yield contributing traits in vegetable amaranth *Journal of Food, Agriculture & Environment*, **12(3)**: 168-174.
- Shukla, S. and Singh, S.P.** (2003). Correlation and path analysis in grain amaranth (*Amaranthus spp.*). *Indian Journal of Genetics and Pant Breeding*, **63(2)**: 163–174, 2003.
- Shukla, S., Bhargava, A., Chatterjee, A., Srivastava, A. and Singh, S.P.** (2006). Genotypic variability in vegetable amaranth (*Amaranthus tricolor* L.) for foliage yield and its contributing traits over successive cuttings and years. *Euphytica*, **151**: 103-110.
- Varalakshmi, B. and Pratap Reddy, V. V.** (1997). Variability, heritability and correlation studies in vegetable amaranth. *South Indian Hort.* **42(6)**: 361-364.
- Vavilov, N. I.** (1951). Origin, variation, immunity and breeding of cultivated plants. *Chronol. Bot.* **13**: 4-364.