www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(7): 2921-2923

www.thepharmajournal.com
Received: 16-04-2023
Accepted: 29-05-2023

Baseerat Afroza
Division of Vegetable Science, Sher-e-Kashmir University of Agricultural Sciences and Technology-Shalimar, Srinagar Kashmir, Jammu and Kashmir, India

Humeera Nazir
Division of Vegetable Science, Sher-e-Kashmir University of Agricultural Sciences and Technology-Shalimar, Srinagar Kashmir, Jammu and Kashmir, India

Asima Amin
Division of Vegetable Science, Sher-e-Kashmir University of Agricultural Sciences and Technology-Shalimar, Srinagar Kashmir, Jammu and Kashmir, India

Rakshanda Anayat
Division of Vegetable Science, Sher-e-Kashmir University of Agricultural Sciences and Technology-Shalimar, Srinagar Kashmir, Jammu and Kashmir, India

Rizwan Rashid
Division of Vegetable Science, Sher-e-Kashmir University of Agricultural Sciences and Technology-Shalimar, Srinagar Kashmir, Jammu and Kashmir, India

Corresponding Author:
Baseerat Afroza
Division of Vegetable Science, Sher-e-Kashmir University of Agricultural Sciences and Technology-Shalimar, Srinagar Kashmir, Jammu and Kashmir, India

Genetic studies in vegetable Amaranth

Baseerat Afroza, Humeera Nazir, Asima Amin, Rakshanda Anayat and Rizwan Rashid

Abstract
In 2019, a study was carried out to evaluate the performance of fifteen different genotypes of Vegetable Amaranth collected from various regions across India during the Kharif season. The research employed a complete randomized block design with three replications at each location for the experiment. This design was chosen to minimize bias and ensure the validity of the results obtained from different locations during the study. Various traits were measured and recorded, including days to germination, length of leaves, leaf area, length of petioles, plant height, stem thickness, number of branches per plant, length of inflorescence, plant spread, days to 50% flowering, number of leaves per plant, average leaf yield per plot, weight of 1000 seeds, average seed yield per plot, soluble solid content (°Brix), ascorbic acid content, total chlorophyll content, anthocyanin content, dry matter percentage, and protein content percentage. The results showed significant variation in most of the traits, indicating a wide range of values within the population. The genotypic coefficients of variation were high for all traits, suggesting considerable genetic diversity among the studied genotypes. The majority of traits exhibited a high broad-sense heritability, implying that a significant portion of the observed variation can be ascribed to genetic factors, with the exception of anthocyanin content. Notably, leaf yield per plot demonstrated positive and significant correlations with various traits, such as days to germination, length of leaves, leaf area, length of petioles, plant height, stem thickness, number of branches per plant, length of inflorescence, plant spread, number of leaves per plant, and average seed yield per plot. These findings suggest that selecting for these traits would likely result in improved leaf yield per plot.

Keywords: Vegetable amaranth, yield, quality, heritability, correlation, genetic advance

Introduction
Amaranthus, also known as Amaranth or locally referred to as "Chaulai" in Kashmir, is a versatile and nutritious vegetable that has been cultivated in the Kashmir region for centuries. This leafy green belongs to the Amaranthaceae family and is highly esteemed for its culinary and health benefits. With its vibrant green leaves and flavorful taste, Amaranthus has gained popularity among the people of Kashmir.
In Kashmir, Amaranthus thrives in the temperate climate and is typically grown during the spring and summer seasons (Katiyar *et al*., 2000; Shukla and Singh, 2000) [2, 6]. The fertile soil and moderate weather conditions of the region provide an ideal environment for its cultivation. Farmers and gardeners in Kashmir value Amaranthus not only for its nutritional value but also for its adaptability to various growing conditions.
Amaranthus is highly regarded for its rich nutritional profile, making it an excellent source of vitamins such as A, C, and K, as well as essential minerals like iron, calcium, and potassium. Furthermore, Amaranthus is renowned for its medicinal properties. It is believed to possess antioxidant and anti-inflammatory effects, which can contribute to overall health and well-being. In traditional medicine, Amaranthus has been utilized for treating various ailments and promoting digestive health.
The significance of Amaranthus in Kashmir goes beyond its nutritional and medicinal attributes. It holds cultural and historical importance, deeply rooted in the culinary traditions of the region. The versatile nature of Amaranthus allows for its incorporation into a wide range of dishes, from salads and stir-fries to soups and curries. Its inclusion in Kashmiri cuisine highlights the local preference for fresh, locally grown, and nutrient-rich vegetables.
In conclusion, Amaranthus, or "Chaulai," holds a cherished place in Kashmiri agriculture and cuisine. Its cultivation in the region benefits from the favorable climate and fertile soil, resulting in a nutritious and versatile vegetable that is valued for its taste, health benefits, and cultural significance.

Materials and Methods

The basic materials consisted of fifteen diverse genotypes of vegetable Amaranth (*Amaranthus* spp.) *viz*., SKAU-A-1, SKAU-A-2, SKAU-A-3, SKAU-A-4, SKAU-A-7, SKAU-A-9, SKAU-A-10, SKAU-A-13, SKAU-A-15, SKAU-A-17, SKAU-A-18, SKAU-A-19, SKAU-A-20, SKAU-A-22, SKAU-A-23. These lines have been maintained by the Division of Vegetable Science, SKUAST-K, Shalimar. The experiment was laid in a completely randomized block design with three replications. The row to row and plant to plant spacing was maintained at 30 cm × 10 cm. Recommended package of practices were adopted to raise a healthy crop at all the three locations.

Results and Discussion

The present investigation was carried out to initiate genetic studies in fifteen vegetable amaranth genotypes during *Kharif* 2019. The variability parameters, including mean, range, phenotypic and genotypic coefficient of variation, phenotypic and genotypic variance, heritability (broad sense), and genetic advance, were calculated and are detailed in Table 1(a) and 1(b). The analysis revealed significant variation across the majority of the investigated traits, as evidenced by the wide range values. This variability is crucial for the potential improvement through selection. Analysis of phenotypic, genotypic, and environmental variances demonstrated that the environmental variances were considerably smaller in magnitude compared to the genotypic variances. This indicates that the observed variations were primarily attributed to the genetic nature of the genotypes.

The genotypic coefficients of variation were found to be higher than the corresponding environmental coefficients of variation. The traits with the highest genotypic coefficients of variation were anthocyanin (152.94), leaf area (82.49), number of branches per plant (66.85), and 1000 seed weight (59.55). This indicates that selecting for these traits would likely be effective. Heritability is a measure of the genetic relationship between parents and offspring and is commonly used to determine the extent to which a trait can be inherited. High heritability suggests that there is a greater proportion of fixable additive variance within the population. Additionally, it reflects the precision with which the assessment of a genotype can be made based on its observable characteristics. Throughout this study, the broad-sense heritability consistently exceeded 60 percent for all traits, indicating that selecting based on phenotype would yield more effective results, with a high probability of passing on these favorable traits to subsequent generations. Most of the traits exhibited low genetic advance, except for leaf area (52.80), plant height (76.04), inflorescence length (26.94), days to 50% flowering (23.26), number of leaves per plant (68.74), average leaf yield per plot (385.85), average seed yield per plot (56.89), and ascorbic acid (59.16). Similar findings regarding variability, variances, heritability, and genetic advance have been reported by previous studies conducted by Shukla *et al*. (2006) [7], Anita *et al*. (2022) [8], Hasan *et al*. (2013) [1], Mobina *et al*. (2013) [4], Salvadora *et al*. (2017) [5], and Malaghan *et al*. (2018) [3].

High heritability and genetic advance are valuable in predicting gains through selection. However, when heritability is high but genetic advance is not proportionately high, it suggests that non-additive genes with dominance and epistatic effects are influencing the traits under consideration. Traits with both high heritability and high genetic advance respond better to selection compared to those with high heritability but low genetic advance.

The correlation coefficients were calculated using variances and covariances to assess the relationships among various traits and their association with leaf yield per plot and seed yield per plot at the genotypic level. The genotypic correlation coefficients for different traits are presented in Table 2. Understanding the degree of correlation between yield or any other target trait and its component traits is crucial for constructing selection indices that enable effective direct selection.

In this study, the genotypic correlation coefficients exhibited higher magnitudes compared to the phenotypic correlation coefficients, while their directions remained similar. The economically important characteristic, leaf yield per plot, displayed positive and statistically significant correlations with various traits, including days to emergence, leaf length, leaf area, petiole length, plant height, stem thickness, number of branches per plant, inflorescence length, plant spread, number of leaves per plant, and average seed yield per plot. These findings suggest that focusing on the improvement of these traits would naturally lead to enhanced overall yield. This observation aligns with previous studies on vegetable amaranth, which have also reported significant correlations between different traits.

Table 1a: Variability parameters for maturity, yield, yield attributing and quality traits in vegetable amaranth (*Amaranthus* spp.) (On data pooled over environments)

S. No.	Characters	Mean	Range	Phenotypic coefficient of variation (PCV) %	Genotypic coefficient of variation (GCV) %	Phenotypic variance (σ^2p)	Genotypic variance (σ^2g)	Heritability in broad sense (%)	Genetic advance
1.	Days to emergence	16.27	12.66 - 20.31	26.73	26.61	18.99	18.82	99.08	8.87
2.	Leaf length (cm)	7.49	5.56 - 8.91	35.78	34.97	7.20	6.91	96.00	5.29
3.	Leaf area (cm$^{2)}$	31.36	17.64 - 42.12	82.55	82.49	670.29	669.77	99.92	52.80
4.	Petiole length (cm)	6.15	4.85 - 7.23	36.42	35.77	5.02	4.87	96.87	4.42
5.	Plant height (cm)	133.30	102.41- 167.40	27.97	27.96	1390.82	1390.00	99.94	76.04
6.	Stem thickness (mm)	11.39	8.77 - 15.42	51.79	51.53	34.90	34.48	98.78	11.91
7.	Number of branches plant^{-1}	7.27	4.87 - 8.80	66.98	66.85	23.70	23.64	99.73	9.93
8.	Inflorescence length (cm)	23.69	17.47 - 31.75	55.76	55.71	174.63	174.27	99.79	26.94
9.	Plant spread (cm)	17.69	15.40 - 21.23	47.93	47.65	71.93	71.13	98.89	17.11
10.	Days to 50% flowering	39.94	34.50 - 46.50	28.56	28.49	130.20	129.58	99.52	23.26
11.	Number of leaves plant^{-1}	62.76	48.80 - 80.66	33.71	33.69	448.08	447.62	99.89	68.74
12.	Average leaf yield plot^{-1}(g)	928.91	683.66 - 1141.16	20.37	20.36	35795.73	35794.77	99.99	385.85
13.	1000 seed weight (g)	0.89	0.83- 0.94	60.67	59.55	0.29	0.28	96.55	1.06
14.	Average seed yield plot^{-1} (g)	85.13	53.94 - 147.12	32.77	32.76	778.57	778.04	99.93	56.89

Table 1b: Variability parameters for maturity, yield, yield attributing and quality traits in vegetable amaranth (*Amaranthus* spp.) (On data pooled over environments)

S. No.	Characters	Mean	Range	Phenotypic coefficient of variation (PCV) %	Genotypic coefficient of variation (GCV) %	Phenotypic variance (σ^2p)	Genotypic variance (σ^2g)	Heritability in broad sense (%)	Genetic advance
15.	SSC (°Brix)	5.92	5.20 - 7.77	28.88	27.87	2.93	2.74	93.36	3.27
16.	Total chlorophyll (mg/100g)	2.86	2.21 - 3.74	37.76	36.71	1.17	1.11	94.56	2.09
17.	Ascorbic acid (mg/100g)	67.87	48.28 - 89.23	42.75	42.74	841.78	841.69	99.98	59.16
18.	Anthocyanin (mg/100g)	0.17	0.04 - 0.33	182.35	152.94	0.10	0.07	70.00	0.45
19.	Dry matter(%)	9.76	8.15 - 11.90	23.97	23.77	5.48	5.38	98.15	4.72
20.	Protein content (%)	0.99	0.65 - 1.24	37.37	33.33	0.13	0.10	78.98	0.59

Table 2: Estimates of genotypic (above diagonal) correlation coefficients among different traits in vegetable Amaranth *(Amaranthus* spp.)

	Days to emergence	Leaf length	Leaf area	Petiole length	Plant height	Stem thickness	Number of branches plant^{-1}	Inflorescence length	Plant spread	Days to 50% flowering	Number of leaves plant^{-1}	Average leaf yield plot^{-1}	1000 seed weight	Average seed yield plot^{-1}
Days to emergence	1.00	-0.072**	-0.069**	0.105	0.716**	- 0.029	0.646**	- 0.134	0.614**	0.933**	0.584**	0.932**	0.671**	0.810**
Leaf length		1.000	0.390**	0.321*	0.674**	0.066	0.092	0.065	-0.058**	0.122	0.038**	0.302**	-0.018**	0.206
Leaf area			1.000	0.356**	0.705**	0.285*	- 0.005	0.079	0.105	0.065	0.255*	0.345**	0.256*	0.363*
Petiole length				1.000	0.396**	0.519**	- 0.390**	0.089	0.034	- 0.150	0.201	0.416**	0.385**	0.371**
Plant height					1.000	0.428**	0.329*	0.242*	-0.830**	0.302*	0.994**	0.757*	0.259*	0.558**
Stem thickness						1.000	0.732**	0.009	- 0.241*	- 0.064	0.891**	0.688**	- 0.086	- 0.348*
Number of branches plant^{-1}							1.000	0.559**	0.577**	- 0.578**	0.306*	0.286*	0.254*	0.258*
Inflorescence length								1.000	0.782**	- 0.092	0.247*	0.323**	0.512**	0.549**
Plant spread									1.000	- 0.539**	0.634**	0.986**	0.152	0.432**
Days to 50% flowering										1.000	0.267*	0.174	0.305**	0.215*
Number of leaves plant^{-1}											1.000	0.809**	0.304**	0.297**
Average leaf yield plot^{-1}												1.000	-0.740**	0.369**
1000 seed weight													1.000	0.222*
Average seed yield plot^{-1}														1.000

, * significant at 5% and 1 respectively

References

1. Hasan M, Akhther CA, Raihan MS. Genetic Variability, Correlation and Path Analysis in Stem Amaranth (*Amaranthus tricolour* L.) Genotypes. The Agriculturists. 2013;11(1):1-7.
2. Katiyar RS, Sudhir S, Sanjay R. Varietal performance of grain amaranth (*Amaranthus hypochondriacus*) on sodic soil. Proceedings of the National Academy of Sciences. 2000;70(2):185-187.
3. Malaghan SN, Revanappa S, Mansur DS, Ajjappalavar PS. Estimates of genetic variability for growth parameters in Amaranth (*Amaranthus* L.) Species. International Journal of Current Microbiological Applied Science. 2018;7(7):1495-1500.
4. Mobina P, Narayan CC, Jagapati T. Biometric evaluation of genotypic variability and genetic advance in amaranth cultivars. Journal of Science and Technology. 2013;2:26-30.
5. Salvadora B, Saraswathi T, Ramalingam J. Genetic Basis of Yield and Quality Variations in Vegetable Amaranth (*Amaranthus tricolour*) to identify the Promising Genotypes. International Journal of Current Microbiology and Applied Sciences. 2017;6(4):2104-2111.
6. Shukla S, Singh SP. Studies on genetic parameters in vegetable amaranth. Journal of Genetics and Breeding. 2000;54:133-135.
7. Shukla S, Bhargava A, Chatterjee A, Srivastava A, Singh SP. Genotypic variability in vegetable amaranth (*A. tricolour*) for foliage yield and its contributing traits over successive cuttings and years. Euphytica. 2006;151:103-110.
8. Trivedi A, Kumar P, Chandra G, Guleria H, Chauhan S. Estimation of genetic variability, heritability and genetic advance in grain amaranth (*Amaranthus hypochondriacus* L.). The Pharma Innovations. 2022;11(3):734-737.