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GENETIC DIVERSITY ASSESSMENT IN GARLIC (*Allium sativum* L.) GENOTYPES FOR YIELD AND QUALITY TRAITS

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Abstract: *The present investigation conducted on thirty diverse genotypes of garlic (Allium sativum L.) to know the variability among the genotypes. The observations were recorded on characters viz., plant height (cm), leaves per plant, length of leaf (cm), width of leaf (cm), neck thickness of bulb (cm), cloves per bulb, weight of clove (g), Length of clove (cm.) diameter of clove (cm), diameter of bulb (cm), T.S.S (%)and bulb Yield per plant (g). The present study revealed that the variance due to treatments were highly significant for all the characters indicating sufficient variability existing in the genotypes. Whereas, the higher magnitude of coefficient of variation at phenotypic as well as genotypic levels observed for weight of clove, neck thickness of bulb and clove per bulb. Phenotypic variation was highest for weight of clove followed by neck thickness of bulb. In the present investigation, the highest estimates of heritability were observed in case of neck thickness of bulb and the highest genetic advance showed in weight of clove. High heritability coupled with high genetic advance in per cent of mean was recorded for neck thickness of bulb, weight of clove, cloves per bulb, bulb yield per plant, plant height and diameter of clove. This indicates that these traits were less influenced by environment.*
Keywords: *Allium sativum L., PCV, GCV, Heritability, Genetic Advance and Yield per plant (g).*

Introduction: Garlic (*Allium sativum* L.) belongs to the family Amaryllidaceae (Alliaceae); known as *Lahsun* in Hindi, is one of the important bulb crop grown in India. It has long been recognized as a valuable spice and condiments in India. It is a frost hardy bulbous, erect annual herb with narrow flat leaves and bears small white flowers and bulbils [1]. Garlic is a scapigerous foetid perennial medicinal herb with underground compound bulbs covered by outer white thin scales with simple smooth round stem surrounded by the bottom by tubular leaf sheath. The leaves are simple, long, flat and linear. The shoot of garlic become flat and finally aborts after the development of bulbils in the inflorescence. A compound bulb consists of smaller bulbils or segments called "cloves" which are formed from auxiliary bulbs of the young foliage leaves and are surrounded by a thin white or pinkish papery sheath. Variability parameters like coefficient of variation, heritability, expected genetic advance, besides degree of association between the various characters and direct effect on bulb yield, is parameter significance in formulating an appropriate breeding strategy aimed at exploited the inherent variability in the original population. Phenotypic variability includes both genotypic and environmental variation and hence changes under different environmental conditions. This type of variability is more useful to a plant breeder for exploitation in controlled selection. Yield is a complex characteristic controlled by several yield contributing components and it is highly influenced by environmental factors, consequently estimates of heritability are useful. The heritability value alone does not have much significance as it fails to account for the magnitude of absolute variability. It is, therefore, necessary to utilize heritability along with genetic advance while attempting for selection.

Materials and Methods

The present investigation was carried out at Main Experiment Station, Department of Vegetable Science, Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) India during *Rabi* 2011-12. Geographically Narendra Nagar

(Kumarganj) falls under humid sub-tropical climate and is located in between 26.47 ^{0}N latitude and 82.12 ^{0}E longitude at an altitude of 113 meters above the mean sea level. The experimental material of garlic used in the present study were, the collections from different places of Maharashtra, Uttar Pradesh, Himanchal Pradesh and Jammu & Kashmir states of India. Experiment was laid out in a Randomized Block Design with three replications. The observations were recorded on characters viz., plant height (cm), leaves per plant, length of leaf (cm), width of leaf (cm), neck thickness of bulb (cm), cloves per bulb, weight of clove (g), Length of clove (cm.) diameter of clove (cm), diameter of bulb (cm), T.S.S (%) and bulb Yield per plant (g), on five randomly selected plants of a treatment in each replication. Average of the data from the sampled plants of each treatment was used for statistical analysis.

The average values for each genotype in each replication for the traits studied were used for further statistical analysis. A brief outline of the procedure adopted for the estimation of statistical parameters. Analysis of variance**,** the data for the component traits was analyzed as per the following model [2]. The calculated 'F' values were compared with the tabulated 'F' values at 5 % level of significance. If the calculated 'F' value was higher than the tabulated, it was considered to be significant. All the characters which showed significant differences among genotypes were further subjected to the analysis for the different parameters. The phenotypic, genotypic, environmental coefficients of variation, heritability in broad sense (h^2_{bs}) and the expected genetic advance (GA) for different characters' content were calculated as suggested [3-4].

Results and Discussion

The present study revealed that the analysis of variance for different characters is presented in table 1. The mean sum of square due to replication was non-significant for all the characters but neck thickness of bulb, weight of clove and length of clove were highly significant. The variation due to genotypes was highly significant for all characters. An insight into the magnitude of variability exists in a crop species of most importance, as it provides the basis of the effective selection. In general, the phenotypic coefficient of variability was higher than genotypic coefficient of variability for all the twelve characters under study which indicates that environment played a considerable role in the expression of their traits. The range of variability of different traits alone does not allow a decision as to which character was showing the highest degree of variability. Therefore, accurate relative comparison can be made with the help of phenotypic and genotypic coefficient of variation. Phenotypic variation was partitioned into genotypic and environmental component. The significant differences were observed among genotypes for all the characters studied. The higher magnitude of coefficient of variation (Table 2.) at phenotypic as well as genotypic levels observed for weight of clove, neck thickness of bulb and clove per bulb. Phenotypic variation was highest for weight of clove followed by neck thickness of bulb. Similar results were reported [5-8]. Genotypic coefficient variation was also highest for weight of clove followed neck thickness of bulb, reported similar results in their studies [9-10]. Moderate variation noted in case of bulb yield per plant and diameter of clove. While low GCV and PCV was observed for total soluble solids (TSS). However, moderate to low variation (Table 2.) exerted for these traits revealed that there is a reasonable scope for improvement in these traits. Heritability in broad sense of a character is important to the breeder since it indicates the possibility and extent to which improvement is possible through selection. It also indicates direction of selection of selection pressure to be applied for the traits during selection because it measures relationship between parent and their progeny, widely used in determining the degree to which a character may be transmitted from parent to offspring. However, high heritability alone is not enough to make efficient selection in advanced generation unless accompanied by substantial amount of genetic advance [4]. The genetic advance is commonly predicted as a product of heritability ratio and selection differentials. Mention that where high heritability value is accompanied by high genetic advance [11]. The progress realized by selection would be most appropriate. In the present investigation, the highest estimates of heritability were (Table 2.) observed in case of neck thickness of bulb and the highest genetic advance showed in weight of clove, reported similar results in their studies [12]. High heritability coupled with high genetic advance in per cent of mean was recorded for neck thickness of bulb, weight of clove, cloves per bulb, bulb yield per plant, plant height and diameter of clove. This indicates that these traits

were less influenced by environment. Similar results were reported [10, 13-14].

Table-1: Analysis of variance for 12 characters in garlic

S. No.	Characters	Source of variation		
		Replication	Treatments	Error
	DF	2	29	58
1	Plant height (cm)	1.195	119.540**	4.653
2	Leaves per plant	0.408	2.476**	0.414
3	Length of leaf (cm)	0.206	40.331**	2.270
4	Width of leaf (cm)	0.021	0.181**	0.028
5	Neck thickness of bulb (cm)	0.080**	0.481**	0.005
6	Cloves per bulb	1.798	202.073**	3.602
7	Weight of clove (g)	0.234**	1.814**	0.030
8	Length of clove (cm)	0.531**	0.348**	0.061
9	Diameter of clove (cm)	0.038	0.133**	0.012
10	Diameter of bulb (cm)	0.060	0.538**	0.085
11	T.S.S. (%)	0.312	9.465**	1.321
12	Bulb Yield per plant (g)	1.554	57.098**	2.128

**, ** = Significant at 5% and 1% probability levels, respectively.*

Table-2: Estimates of range, grand mean, phenotypic and genotypic coefficient of variation (PCV & GCV), heritability and genetic advance for 12 characters in garlic

S. N.	Characters	Range		Grand Mean	Coefficient of variation		Heritability in broad sense	Genetic advance	Genetic advance in % of mean
		Minimum	Maximum		Phenotypic (PCV%)	Genotypic (GCV (%)			
1	Plant height (cm)	36.43	67.94	57.97	11.30	10.67	89.17	12.04	20.76
2	Leaves per plant	6.60	10.47	8.05	13.04	10.30	62.40	1.35	16.76
3	Length of leaf (cm)	30.12	44.61	38.80	9.970	9.18	84.82	6.76	17.42
4	Width of leaf (cm)	1.23	2.51	1.54	18.24	14..62	64.21	0.37	24.13
5	Neck thickness of bulb (cm)	0.56	2.50	0.98	41.22	40.62	97.10	0.81	82.45
6	Cloves per bulb	9.68	38.40	21.75	38.40	37.39	94.84	16.32	75.02
7	Weight of clove (g)	1.01	5.13	1.50	52.77	51.49	95.23	1.55	93.51
8	Length of clove (cm)	1.40	3.13	2.37	16.71	13.07	61.07	0.51	21.02
9	Diameter of clove (cm)	0.85	1.74	1.13	20.20	17.67	76.51	0.36	31.84
10	Diameter of bulb (cm)	2.69	4.61	3.84	12.65	10.12	64.03	0.64	16.69
11	T.S.S (%)	34.37	42.27	39.47	5.09	4.17	67.27	2.78	7.05
12	Bulb Yield per plant (g)	12.09	28.17	21.28	21.25	20.12	89.60	8.35	39.23

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