Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2582-2845.8600

ISSN: 2582 – 2845

Ind. J. Pure App. Biosci. (2021) *9*(1), 297-302

Indian Journal of Pure & Applied Biosciences

Peer-Reviewed, Refereed, Open Access Journal

Research Article

Studies on Genetic Diversity and Variability for Yield and Yield attributes in Garlic (*Allium sativum* L.) Under Dhampur Condition

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Received: 4.01.2020 | Revised: 11.02.2020 | Accepted: 17.02.2021

ABSTRACT

The experiment was conducted at Horticulture Research Farm, Dhampur, Bijnor during rabi season of 2019-20. In the present investigation 21 genotypes of garlic (Allium sativum L.) were evaluated in RBD with the objective of estimating the genetic variability and determination of association among different attributes with each other and with bulb yield. Analysis of variance for design of experiment revealed that there is the weight of fresh bulbs had highly significant and positive correlation with plant equatorial diameter, weight of dry bulbs, leaf length, sulphur contain indicated that selection for these traits would be effective for the improvement of yield (q/ha). The maximum positive direct effect on yield (q/ha) was exerted by number of cloves/bulb, leaf width, polar diameter, plant height (cm), height of pseudo stem, total soluble solid, protein(%), plant pseudo stem diameter, width of leaf and number of leaves/plant. It is suggested that selection for these traits will directly increase yield (q/ha).

Keywords: *Garlic, Variability, Correlation, RBD, Allium sativum.*

INTRODUCTION

Garlic (*Allium sativum* L.) belongs to the family Alliaceae (Allen, 2009). It is an apomyctic diploid species (2n=2x=16). The origin of garlic is thought to be in central Asia (India, Afghanistan, West China, Russia) and spread to other parts of the world through trade and colonization (Tindal, 1986). Garlic has been used in china and India for more than 500 years, and Egypt since 2000 B.C (Kamenetsky & Rabinowitch, 2001). Garlic is the most important Allium crops and ranks second next to onion in the world (Voigt, 2004).

The total area under garlic cultivation in India is (2.45 million hectare) and production is (3.65 million tonnes) with productivity of (18.72 million tonnes/hectare) (NHRDF, 2020). With respect to its production and economic value, garlic is one of the main Allium vegetable crops in the world and used as a seasoning in many food throughout the globe. Garlic has also medicinal value which is well recognized in the control and treatment of hypertension, worms, germ, bacterial and fungal diseases diabetes, cancer, ulcer, rheumatism etc.

Cite this article: Kumar, D., & Kumar, V. (2021). Studies on Genetic Diversity and Variability for Yield and Yield attributes in Garlic (*Allium sativum* L.) Under Dhampur Condition, *Ind. J. Pure App. Biosci. 9*(1), 297-302. http://dx.doi.org/10.18782/2582-2845.8600

(Kilgori et al., 2007(b) Samavatean et al., 2011, & Kamenetsky et al., 2006) Many people perceived and appreciated garlic for its many medicinal attributes (Rabinowitch & Currah, 2002).

MATERIALS AND METHODS

The field experiment was conducted at Horticulture Research Farm (HRF) at R.S.M (PG) College, Dhampur, Bijnor, Uttar Pradesh India. Geographically it is situated between 29^0 15' 27.5328" latitude in the north and 78^o 30' 0.2196" longitudes in the eastern elevation of about 235 m above mean sea level. The experimental materials of garlic used in the present study were collected from different places of India. The experiment was laid out in Randomize Block Design (RBD). These 21 genotypes were evaluated and studied for their growth, yield and quality performance based on morphological and agronomical measurements. The following observations were recorded during the course of experimentation on following characters like- Plant height (cm), number of leaves/plant, length of leaf (cm), width of leaf (cm), plant pseudo stem height (cm), plant pseudo stem diameter (mm), equatorial diameter of bulbs (mm), polar diameter of bulbs (mm), weight of fresh bulbs (g), weight of dry bulbs (g), number of cloves/bulb, yield (q/ha), total soluble solids (%). protein (%), sulphur contain (%). These observations were recorded on five randomly selected plants of each row. Averages of data from the sampled plant of each treatment were used for statistical analysis in order to draw valid conclusion. The statistical parameters like- mean, ranges were calculated as per the standard methods of analysis.

RESULTS AND DISCUSSION

The analysis of variance for the design of experiment indicated that the mean squares due to genotypes were highly significant for most of the characters indicating a wide genetic variability among the genotypes in Table 1. The variation due to checks were also highly significant for are the characters like- plant height (58.91 cm), Plant pseudostem height (3.87 cm), number of leaves per plant (1.06), length of leaf (15.68 cm), width of leaf (6.72 mm), Plant pseudostem diameter (3.97 mm), Equatorial diameter of bulbs (25.71 mm), Polar diameter of bulbs (20.07 mm), number of cloves per bulb (22.96), weight of fresh bulbs (152.72 g), weight of dry bulbs (122.57 g), Yield quantal/ha (1573.66), total soluble solids (9.25%), Sulphur contain (0.0005 %), Protein (0.30 %). Mean performance serves as an important criterion in eliminating the undesirable types in a selection progrmme.Tesega K and Tiwari (2016)[10]. The phenotypic correlation coefficients were worked out to measure the association among the fiften characters under study. The estimates of these correlation coefficients are presented in table-2. Plant height showed highly positive and significant correlation at phenotypic level with weight of fresh bulbs (0.562), leaf length (0.459), weight of dry bulb (0455), Equatorial Diameter of bulbs (0.440) and polar diameter (0.313), whereas sulphur content (-246) showed negative and significant correlation with the trait.Plant pseudo-stem height showed positive and significant correlation with number of leaf (0.567), leaf width (0.319). Whereas negative and significant correlation with polar diameter (-0.484), total soluble solids (-0.273).Number of leaf showed positive and significant correlation with leaf width (0.708), polar diameter (0.541), weight of dry bulbs (0.478), pseudo-stem diameter (0.436), yield q/ha (0.427), weight of fresh bulbs (0.415), equatorial diameter of bulbs (0.364), and total soluble solids (0.247). Leaf length showed positive and significant correlation with weight of fresh bulbs (0.437), plant pseudo-stem diameter (0.433), weight of dry bulbs (0.377), leaf width (0.284) and equatorial diameter of bulbs (0.261). Leaf width showed positive and significant correlation with plant pseudo-stem diameter (0.583), yield q/ha (0.494), total soluble solids (0.436), polar diameter (0.425), weight of dry bulbs (0.411), weight of fresh bulbs (0.397), and equatorial diameter (0.343). All other traits were not

found to be significantly correlated with the leaf width. Plant pseudo-stem diameter showed positive and significant correlation with weight of fresh bulbs (0.673), weight of dry bulbs (0.659), yield q/ha (0594), equatorial diameter of bulbs (0.511), number of cloves/ bulbs (0.444), polar diameter (0.382), protein content (0.348), and total soluble solids (0.338). Equatorial diameter of bulbs showed positive and significant correlation with weight of dry bulbs (0.764), weight of fresh bulbs (0.755), polar diameter (0.370) and yield q/ha (0.323), whereas positive and non significant correlation with protein (0.175) and sulphur content (0.001) and total soluble solids (-0.81). Polar diameter showed positive and significant correlation with weight of dry bulbs (0.493), weight of fresh bulbs (0.462) and yield q/ha (0.258) whereas negative and significant correlation with sulphur content (-0.276). Number of cloves/plant showed positive and significant correlation with yield q/ha (0.362), sulphur content (0.338), weight of dry bulbs (0.328), weight of fresh bulbs (0.287), and protein (0.296).Weight of fresh bulbs showed positive and significant correlation with weight of dry bulbs (0.562), leaf length (0.437), yield q/ha (0.450) and protein (0.320) whereas positive and non significant correlation with total soluble solids (0.156) and sulphur content (-0.131) was recorded. Yield q/ha showed positive and significant correlation protein (0.428) highly significant and total soluble solids (0.300) significant. Total soluble solids showed positive and significant correlation protein (0.429) highly significant whereas positive and non significant correlation was found with sulphur contain (0.023). The genotypic correlation coefficients were worked out to measure the association among the fifteen characters under study. The estimates of these correlation coefficients are presented in table-3 Plant height showed positive and significant correlation with weight of fresh bulbs (0.663), Equatorial diameter (0.608), weight of dry bulbs (0.595), leaf length (0.504), sulphur contain (0.406) whereas negative and significant correlation with total soluble solids (-0.305) and protein content (-0.259). Plant pseudo-stem height showed positive and significant correlation with leaf width (0.922), number of leaf (0.889), protein content (0.481), total soluble solids (0.439), weight of dry bulbs (0.354), number of cloves/plant (0.347) and sulphur content (0.326) whereas genotype negative and significant correlation polar diameter (-0.708) highly significant and weight of fresh bulbs (-0.305). Plant pseudo-stem height showed positive and significant correlation with leaf width (1.031), polar diameter (0.757), weight of dry bulbs (0.564), yield q/ha (0.526), plant pseudo-stem diameter (0.512), weight of fresh bulbs (0.437), protein (0.362), equatorial diameter of bulbs (0.348) and total soluble solids (0.306). Leaf length showed positive and significant correlation with weight of fresh bulbs (0.756), weight of dry bulbs (0.744), plant pseudo-stem diameter (0.582), equatorial diameter bulbs (0.530) highly significant, yield q/ha (0.261) and polar diameter (0.258). Leaf width showed positive and significant correlation with plant pseudo-stem diameter (0.874) highly significant, weight of dry bulbs (0.846) highly significant, yield q/ha (0.832), polar diameter (0.771), weight of fresh bulbs (0.693), protein (0.585), equatorial diameter of bulbs (0.524), total soluble solids (0.463), number of cloves/plant (0.282). Plant pseudo-stem diameter showed positive and significant correlation with yield q/ha (0.833), weight of dry bulbs (0.825), weight of fresh bulbs (0.823), protein (0.694), equatorial pseudo-stem diameter (0.649), number of cloves/plant (0.576), number of cloves/plant (0.576), number of cloves/plant (0.576), number of cloves/plant (0.576), polar diameter (0.484).Equatorial diameter of bulbs showed positive and significant correlation with weight of dry bulbs (0.947), weight of fresh bulbs (0.931), yield q/ha (0.507)), polar diameter (0.483)), protein (0.409)) and total soluble solids (0.341)). Polar diameter showed positive and significant correlation with weight of dry bulbs (0.651), weight of fresh bulbs (0.585)), protein (0.530)), yield q/ha (0.467)) and sulphur contain (0.436)). Number of cloves/bulbs showed positive and

significant correlation with protein (0.716), yield q/ha (0.606), sulphur contain (0.490), weight of dry bulbs (0.470), and weight of fresh bulbs (0.368). Weight of fresh bulbs showed positive and significant correlation with weight of dry bulbs (0.961), yield q/ha (0.628), protein (0.557). Weight of dry bulbs showed positive and significant correlation with yield q/ha (0.694), and protein (0.559). Yield q/ha showed positive and significant correlation with protein (0.759) and total soluble solids (o.534). Total soluble solids showed positive and significant correlation with protein (0.819); and Sulphur contains showed positive and significant correlation with protein (0.399). In general the estimates of genotypic correlation coefficients between different characters showed close parallelism in direction with their corresponding phenotypic correlation coefficients presented in Table 2 and Table 3. Similar results were reported by, Tiwari et al. (2014), Tsegas & kasshum (2011), Yadav & Singh (2007), Yadav & Singh, (2012), Pense et al. (2014) and Peryin et al. (2014).

Table 1: Mean sum squares genotypes

Source of variation	d.f.	Plant height(cm)	Plant pseudo stem height(cm)	Number of leaves/plant	Leaf length(cm)	Leaf Width (mm)	Plant pseudo stem diameter(mm)	Equatorial diameter of bulbs(mm)	Polar diameter(mm)
Replication	2	2.22	1.14	0.32	8.20	0.02	1.57	5.70	0.74
Treatment	20	58.91**	3.87**	1.06**	15.68**	6.72**	3.97**	25.71**	20.07**
Error	40	6.28	0.87	0.15	4.34	2.08	0.46	3.81	2.20

Source of variation	d.f.	Number of cloves/bulb	Weight of fresh bulbs(g)	Weight of dry bulbs(g)	Yield(q/ha)	Total soluble solids %	Sulphur content %	Protein %
Replication	2	4.06	35.27	42.67	232.21	4.55	0.0000	0.11
Treatment	20	22.96**	152.72**	122.15**	1573.66**	9.25**	0.0005**	0.30**
Error	40	2.17	22.71	16.96	298.23	2.65	0.0001	0.16

Table 2: Phenotypic correlation

Characters	Plant Height	Plant seudostem height	Number of leaf	Leaf length	Leaf Width (mm)	Plant Seudostem diameter	Equatorial Diameter of bulbs	Polar Diameter	No of cloves /bulb	Weight of fresh bulbs	Weight of Dry bulbs	Yield quintal/ha	Total soluble solids %	Sulphur content %	Protein %
Plant Height	1.000	0.050	0.138	0.459**	0.131	0.200	0.440**	0.313*	0.003	0.562**	0.455**	0.008	-0.030	-0.246*	-0.047
Plant seudostem height			-0.567**	-0.008	-0.319**	-0.095	-0.148	-0.484**	0.171	-0.146	-0.205	0.032	-0.273*	0.157	-0.159
Number of leaf				0.152	0.708**	0.436**	0.364**	0.541**	0.081	0.415**	0.478**	0.427**	0.247*	-0.076	0.188
Leaf length					0.284*	0.433**	0.261*	0.095	0.077	0.437**	0.377**	0.208	0.005	0.032	0.097
Leaf Width (mm)						0.583**	0.343**	0.425**	0.090	0.397**	0.411**	0.494**	0.436**	0.063	0.227
Plant Seudostem dia.							0.511**	0.382**	0.444**	0.673**	0.659**	0.594**	0.338**	0.100	0.348**
Equatorial Dia. of bulbs								0.370**	0.178	0.755**	0.764**	0.323**	-0.081	0.001	0.175
Polar Diameter									0.067	0.462**	0.493**	0.258*	0.222	-0.276*	0.212
No of cloves /bulb										0.287*	0.328**	0.362**	0.055	0.338**	0.296*
Weight of fresh bulbs											0.908**	0.450**	0.156	-0.131	0.320**
Weight of Dry bulbs												0.471**	0.047	-0.039	0.255*
Yield quintal/ha													0.300*	0.064	0.428**
Total soluble solids %														0.023	0.429**
Sulphur content %															0.223
Protein %															1.000

*, ** significant at 5% and 1% level, respectively

Table 3: Genotypic correlation

Characters	Plant height	Plant seudostem hieght	Number of leaf	Leaf length	Leaf Width (mm)	Plant Seudostem diameter	Equatarial Diameter of bulbs	Polar Diameter	No of cloves /bulb	Weight of fresh bulbs	Weight of Dry bulbs	Yield quantal/ha	Total soluble solids %	Sulphur content %	Protein %
Plant height	1.000	-0.074	0.077	0.504**	-0.001	0.205	0.608**	0.421**	-0.045	0.663**	0.595**	-0.079	-0.305*	-0.406**	-0.259*
Plant seudostem hieght			-0.889**	-0.044	-0.922**	-0.232	-0.215	-0.708**	0.347**	-0.305*	-0.354**	-0.170	-0.439**	0.326**	-0.481**
Number of leaf				0.153	1.031**	0.512**	0.348**	0.757**	0.030	0.437**	0.564**	0.526**	0.306*	-0.232	0.362**
Leaf length					0.201	0.582**	0.530**	0.258*	0.160	0.756**	0.744**	0.261*	-0.134	0.037	-0.008
Leaf Width (mm)						0.874**	0.524**	0.771**	0.282*	0.693**	0.846**	0.832**	0.463**	-0.065	0.585**
Plant Seudostem dia.							0.649**	0.484**	0.576**	0.823**	0.825**	0.833**	0.398**	0.119	0.694**
Equatarial Dia. of bulbs								0.483**	0.226	0.931**	0.947**	0.507**	-0.341**	-0.133	0.409**
Polar Diameter									0.087	0.585**	0.651**	0.467**	0.300*	-0.436**	0.530**
No of cloves /bulb										0.368**	0.470**	0.606**	0.092	0.490**	0.716**
Weight of fresh bulbs											0.961**	0.628**	0.045	-0.187	0.557**
Weight of Dry bulbs												0.694**	-0.087	-0.069	0.559**
Yield quantal/ha													0.534**	0.024	0.759**
Total soluble solids %														-0.100	0.819**
Sulphur content %															0.399**
Protein %															1.000

*, ** significant at 5% and 1% level, respectively

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