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Studies of genetic variability and correlation among the characters of different genotypes of garlic (*Allium sativum* L.)

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Abstract

The present investigation entitled “Studies on genetic variability and character association.” The experiment was executed at Main Experiment, Station of Department of Vegetable Science, Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad, during *Rabi* season 2016-2017. The experimental material for the present study consisted of eighty genotypes, with plot size of 2.0×0.60 m² with distance of 30 cm row to row and 10 cm plant to plant. Observation were recorded on plant height (cm), number of leaves per plant, length of leaf (cm), width of leaf (cm), neck thickness of bulb (cm), diameter of bulb (cm), bulb yield per plant (g), number of cloves per bulb, length of clove (cm), weight of clove (g), diameter of clove (cm).

Analysis of variance for design of experiment revealed that there is the length of leaf had highly significant and positive correlation with plant height, number of leaves per plant and diameter of bulb indicated that selection for these traits would be effective for the improvement of bulb yield per plant. The maximum positive direct effect on bulb yield per plant was exerted by number of cloves per bulb, weight of clove, total soluble solids, neck thickness of bulb, width of leaf and number of leaves per plant. It is suggested that selection for these traits will directly increase bulb yield per plant.

Keywords: garlic, variability, correlation

Introduction

Garlic (*Allium sativum* L.) having diploid chromosome number $2n=2x=16$ 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 (Janick, 1979) [5]. Garlic is a scapigerous foeti 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 flowers are small and white, arranged in round umbels mixed with small bulbils. The entire umbels are enclosed in a tear-drop shaped membranous spathe. Flowers are usually sterile. The seed stalk bears terminal inflorescence, which in terms bear bulbils instead of flowers. The shoot of garlic become flat and finally aborts after the development of bulbils in the inflorescence (Kothari and Shah, 1974) [6]. A compound bulb consists of smaller bulbils or a segment called “cloves” which are formed from auxiliary bulbils of the young foliage leaves and is surrounded by a thin white or pinkish papery sheath.

In India, the total area covered under garlic is about 0.26 Million hectare with production of 1.42 Million tonnes and their productivity is 5.43 tonnes per hectare of bulb. (Anonymous, 2015-16). Madhya Pradesh is the leading state in garlic production, its share, 0.06 Million hectare area with 0.27 Million tonnes production. The important garlic growing states are Gujarat, Maharashtra, Uttar Pradesh, Andhra Pradesh, Orissa, Tamil Nadu and Rajasthan.

Garlic is used all over the world for flavouring, various kinds of dishes and as condiment, notable in chutneys, pickles, curry powders, curried vegetables, meat preparation, tomato ketchup etc. The green top as well as bulbs of garlic are used for the same. Dehydrated garlic in powdered or granulated form is replacing the fresh bulb for industrial and home use in many countries. Recently, spray-dried garlic is also available from some years.

Garlic has good medicinal properties, it has been reported that daily intake of garlic reduces the level of serum cholesterol which is responsible for heart attack. Its preparations are administrated as a cure against some long and lingering stomach disease and sore eyes and

cough. Its juice is also used as a medicine in some skin diseases.

Garlic has high nutritive value. It has been considered as a rich source of carbohydrate, protein and phosphorus. Ascorbic acid content was reported to be very high in green garlic. It is rich in vitamins like thiamine, riboflavin and niacin. Volatile oil contains allicin (diallyl thiosulfinate), an active odour principles of garlic. Other major compounds present are diallyl disulphide, diallyl trisulfide, allyl methyl trisulphide and allyl methyl disulphide. The uninjured bulb contains a colourless, odourless and water soluble amino acids called 'Allin' and converted into 'allicin' after crushing the bulb of Correlation coefficient measures the natural linear relationship between two are more variables. Correlation coefficient among different characters is either positive or negative and it may be high or low. It gives an idea about the various associations. Estimation of correlation coefficient among the yield contributing characters is necessary to understand the direction of selection and to maximize yield in the shortest period of time.

The concept of path analysis was given by Wright (1921)^[16, 17] but the technique was first used by Dewey and Lu (1959)^[4]. Path coefficient analysis is simply standardized partial regression coefficient which split the correlation coefficient into the measures of direct and indirect effect on independent variable. In other words it measures the direct and indirect contribution of various independent characters on dependent character. It also estimates residual effect. Path coefficient analysis is useful in indirect selection. Garlic being an important crop need an attention about genetic improvement.

Material and method

The present investigation entitled "Studies on genetic variability and character association in garlic (*Allium sativum* L.)" was carried out at the Main Experiment Station, Department of Vegetable Science, Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.), India during Rabi 2016-17.

The details of materials used & methods employed during the present investigation has been referred in the subsequent paragraphs. The experiments were conducted at Main Experiment Station, Department of Vegetable Science, Narendra Deva University of Agriculture and Technology, (Narendra Nagar) Kumarganj, Faizabad (U.P.) India in well leveled field having proper drainage facilities. This vegetable farm is situated in the main campus of the university on left side of Faizabad- Raebareli road at a distance of 42 km away from main city of Faizabad district. Geographically the experimental site (Kumarganj, Faizabad) falls under humid sub-tropical climate and is located at 26.47° N latitude and 82.12° Longitude at an altitude of 113 meter above the mean

sea level. Geographically, it falls in the north east gangetic alluvial plains of eastern U.P. region. The experimented design was augmented with 80 (77 genotypes + 3 checks) genotypes with 7 blocks and spacing 30cm x10cm

Result and Discussion

The result of analysis of variance for Augmented Design was carried out for thirteen characters and the results obtained are presented in table-1

The variation due to the blocks were significant for all the characters and variance due to checks were also highly significant for all the characters like plant height (2.77 cm), number of leaves per plant (1.07), length of leaf (18.93 cm), width of leaf (0.17 cm), diameter of bulb (0.28 cm), neck thickness of bulb (0.157 cm), number of cloves per bulb (65.8), bulb yield per plant (20.13 g), length of clove (0.307 cm), weight of clove (0.14 g), diameter of clove (0.28 cm) and TSS (12.03 %).

The analysis of variance for different characters is presented in table1. The mean squares due to genotypes were highly significant for all the characters in blocks and checks. In other words, the performances of the genotypes with respect of these characters were statistically different; suggesting that, there exists ample scope for selection in different traits for garlic improvement.

Table 1: Analysis of variance (Augmented design) for 12 characters in garlic germplasm.

Characters	Sources of variation		
	Blocks	Check	Error
	6 (d.f)	2 (d.f)	12
Plant height (cm)	364.70**	2.77	36.68
Number of leaves per plant	3.77**	1.07*	0.24
Length of leaf (cm)	42.35**	18.93**	2.10
Width of leaf (cm)	0.58**	0.17*	0.03
Diameter of Bulb (cm)	0.97**	0.28*	0.06
Neck Thickness of Bulb (cm)	0.02	0.15*	0.02
Bulb Yield per plant (g)	3.69	20.13**	1.35
Number of cloves per Bulb	34.29**	65.80**	0.91
Length of Clove (cm)	0.16	0.30*	0.07
Weight of clove (gm)	0.07**	0.14**	0.01
Diameter of Clove (cm)	0.05	0.28**	0.03
Total Soluble Solids (%)	9.45**	12.03**	0.88

** Significant at 5% and 1% probability level, respectively

The phenotypic correlation coefficients were worked out to measure the association among the thirteen characters under study. The estimates of these correlation coefficients are presented in table-2. 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

Table 2: Phenotypic (P) correlation coefficients between 12 characters in garlic germplasm

Characters	Number of leaves per plant	Length of leaf (cm)	Width of leaf (cm)	Diameter of Bulb (cm)	Neck Thickness of Bulb (cm)	Number of cloves per Bulb	Length of Clove (cm)	Weight of Clove (g)	Diameter of Clove (cm)	T.S.S. (%)	Yield per plant (g)
Plant height (cm)	0.4514**	0.5713**	0.2892**	0.4171**	0.0703	0.2353*	0.3185**	0.0016	-0.1473	0.2959**	0.1124
Number of leaves per plant		0.1147	0.2240*	0.3942**	0.0086	0.3494**	0.3590**	-0.0165	-0.0578	0.1949	0.2535*
Length of leaf (cm)			0.1261	0.2734*	0.2869**	0.0620	0.2069	0.0331	0.0015	0.1264	-0.0489
Width of leaf (cm)				0.2213*	0.2537	-0.0921	0.1771	-0.1073	-0.0747	0.0367	-0.0712
Diameter of Bulb (cm)					0.0066	0.2372*	0.2880**	-0.0668	0.0026	0.0382	0.0860
Neck Thickness						-0.0029	-0.1136	0.0356	-0.0281	0.1884	-0.0070

of Bulb (cm)												
Number of cloves per Bulb							0.3360**	-0.0368	-0.2006	0.1871	0.4327**	
Length of Clove (cm)								0.0051	-0.0076	0.2091	0.0301	
Weight of Clove (g)									0.0416	-0.0538	0.0326	
Diameter of Clove (cm)										-0.1807	-0.1146	
T.S.S. (%)												-0.05336

*,** Significant at 5% and 1% probability level, respectively

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