



CORRELATION AND PATH ANALYSIS FOR YIELD AND YIELD CONTRIBUTING CHARACTERS IN GARLIC (*ALLIUM SATIVUM* L.)

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ABSTRACT

Correlation and Path Analysis in thirteen genotypically diverse indigenous genotypes and one wild mutant of garlic (*Allium sativum* L.) were studied at the College of Agriculture, Nandurbar during the years 2010-11 for seven important characters. Number of cloves per bulb showed positive significant correlation with yield of bulb per plant both at genotypic and phenotypic level. Number of cloves per bulb showed significant negative correlation with stomatal length, stomatal breadth both at genotypic and phenotypic level, whereas it showed negative non-significant correlation with no. of stomata per microscopic field at genotypic level and positive non-significant correlation at phenotypic level. Length of stomata recorded highest indirect effect on yield / plant through number of stomata per microscopic field at genotypic level. Breadth of stomata recorded highest indirect effect on yield per plant through length of stomata. Length of stomata and no. of cloves / bulb exerted the highest positive direct effect on yield of bulb per plant. Number of leaves per plant recorded highest indirect effect on the yield of bulb per plant through length of stomata.

KEY WORDS: Correlation, Path analysis, Garlic, Stomata.

INTRODUCTION

Garlic (*Allium sativum* L.) is a bulbous perennial food plant of the family *alliaceae*. It is important spice crop having flavor enhancing capacity and medicinal values. The genus *allium* includes over 600 species in North Temperate Zone. All cultivated edible forms of garlic have basic chromosome number $x = 8$. In North Temperate Zone, it is exclusively propagated by cloves. Some cultivar produced flowers mixed with bulbils. Number of clones collected in Soviet Central Asia which was found to be fertile and have yielded seeds which may be useful breeding material. Genetic improvement in any crop requires basic variability for various traits in different varieties. This variability is used for recombination using hybridization in bisexual plants. Correlation and path analysis in respect to various desirable characters in garlic help in isolating promising line for hybridization programme, explore yield potential and quality parameters. Association of various characters with yield and among themselves would provide criteria for indirect selection through components for improvement in garlic yield. The present investigation was therefore undertaken with object to evaluate the correlation and path analysis among materials, consisted of 14 genotypes of garlic with respect to seven characters.

MATERIALS & METHODS

The experiment was carried out at the experimental farm of Department of Botany, College of Agriculture, Latur. Material for present investigation effort includes the bulbs of 13 cultivated garlic varieties *i.e.* G-1, G-41, G-50, G-282,

GG-2, DARL-52, AC-50, GG-3, GG-4, AFP, Godavari, Phule Baswant, Bhima omkar, and seeds of one wild (mutant) garlic. Out of these 13 cultivated varieties were collected from onion and garlic research station, Rajgurunagar, Pune, and seeds of wild (mutant) garlic were collected from medicinal garden of College of Agriculture, Latur. The experiment carried out in Randomized Block Design (RBD) by taking three replications. Observation were recorded for yield and yield contributing traits *i.e.* No. of Leave / Plant, Length of Leaves / Plant (cm), No. of Cloves / bulb, No. of Stomata / Microscopic field, Length of Stomata (μm), Breadth of Stomata (μm) and Yield of bulb/plant (gm). For stomatal study a procedure was standardized. The leaves of plants of one month age were used to obtain the epidermal peel. Excellent peel was removed from these leaves. The peel obtained was mounted in a drop of water on a glass slide and observed under microscope. Length and breadth of stomata was estimated from five random microscopic field were recorded in micrometer (μm) and average number of stomata per microscopic field were counted. Photographs were obtained with Olympus camera at (40 \times 10) magnification. Standard error and critical difference at 1 and 5 percent level of significance were calculated by using the formula (Panse and Sukhatme, 1985). Heritability (broad sense) was calculated according to the method suggested by Allard (1960). Path covariance analysis was carried out according to Dewey and Lu (1959).

RESULTS & DISCUSSION

When a particular character is influenced by number of factors, it becomes necessary to evaluate as to how and to what extent they are associated with each other. The correlation studies of seven quantitative characters were worked out at genotypic and phenotypic levels in order to know the absolute association among characters. Photographs of the genotypes are given in Fig. 3. Phenotypic and Genotypic correlations coefficients were worked out for seven quantitative characters *via.* No. of leaves/ plant, Length of leaves/ per plant (cm), No. of cloves per bulb, No. of stomata per microscopic field, Length of stomata (μm), Breadth of stomata (μm), Yield of bulb/ plant (gm) and are represented in Table 1. Positive and significant phenotypic and genotypic correlations were noted between number of leaves per plant and length of leaves per plant, stomatal length and stomatal breadth. Whereas negative significant phenotypic and genotypic correlations are notated for no. of cloves per bulb, no. of stomata per microscopic field and yield of bulb per plant. The character number of cloves per bulb showed positive significant correlation with yield of bulb per plant both at genotypic and phenotypic level. The results are in agreement with earlier results reported by Kohil and Prabal (2000), Raj-narayanan and Khan (2002), Naruka and Dhaka (2004), Singh *et al.* (2013). Number of cloves per bulb showed significant negative correlation with stomatal length, stomatal breadth both at genotypic and phenotypic level, whereas it showed negative non-significant correlation with no. of stomata per microscopic field at genotypic level and positive non-significant correlation at phenotypic level. The correlation did not show the exact picture at direct and indirect effects of yield contributing characters. Path analysis was carried out to find out the extent and nature of direct and indirect effects on yield components on yield of bulb per plant. Direct and indirect effect at yield component and their genotypic correlation with yield of bulb per plant are presented in Table 2.

It is revealed from Table.2 that, the length of stomata (0.876) followed by no. of cloves / bulb (0.199) exerted the highest positive direct effect on yield of bulb per plant. Number of leaves per plant recorded highest indirect effect on the yield of bulb per plant through length of stomata (0.864). Length of leaves per plant recorded highest the indirect effect on yield of bulb / plant through length of stomata (0.826), No. of stomata per microscopic field (0.070). Number of cloves per bulb recorded highest indirect effect on yield of bulb per plant through number of leaves per plant (1.237). Length of leaves per plant (0.305) and Breadth of stomata (0.074). No. of stomata per microscopic field recorded highest indirect effect on yield / plant through number of leaves per plant (0.323), length of leaves per plant (0.119). Length of stomata recorded highest indirect effect on yield / plant through number of stomata per microscopic field at genotypic level (0.020). Breadth of stomata recorded highest indirect effect on yield per plant through length of stomata (0.487). The present investigation revealed that the characters number of leaves per plant, length of leaves per plant, number of cloves per bulb, number of stomata per microscopic field, length of stomata, breadth of stomata, had strong association with yield of bulb per plant. Results are in agreement with findings of Yadav *et al* 2007. The wild (mutant) plant showed flowering. Flowers are found in April & May. The flowers are white, born clustered, umbels on a naked stem, with an egg-shaped, 2-valved spathe. The flowering stem is solitary. Flowers were perfect with 6 petals, 6 anthers and 3 locules consisting of 2 ovules. The number of flower in a umbel varied from less than 10 to over 100. This produced seeds after maturity (Fig. 1). The pollens are heteropolar with oval shape having two plains of symmetry and its longitudinal axis is longer than polar axis which ranges from $39\mu\text{m}$ - $26\mu\text{m}$. which gives the pollen grain flatten shape. Pollen fertility percentage recoded up to 76%. (Fig. 2).



Fig. 1. Flower of wild (mutant) Garlic

Fig. 2. The heteropolar with oval shape pollens of wild (mutant) Garlic

TABLE 1 : Estimation of Genotypic and Phenotypic Correlation Coefficient between Yield and Yield Contributing Characters

Sr. No.	Characters	No. of Leaves/plant		Length of Leaves (cm)		No. of Cloves / bulb		No. of stomata / microscopic field		Length of Stomata (µm)		Breath of Stomata (µm)		Yield of bulb / plant (gm)
		No. of Leaves/plant	Length of Leaves (cm)	No. of Cloves / bulb	No. of stomata / microscopic field	Length of Stomata (µm)	Breath of Stomata (µm)							
1.	No. of Leaves / plant	G 1.000	0.925**	-0.939**	-0.245	0.986**	0.410**	-0.970**						
		P 1.000	0.905**	-0.919**	-0.239	0.792**	0.386*	-0.957**						
2.	Length of Leaves /plant (cm)	G 1.000	1.000	-0.892**	-0.347**	-0.943**	-0.446**	-0.911**						
		P 1.000	1.000	-0.870**	-0.338**	-0.785**	-0.432**	-0.897**						
3.	No. of Cloves /bulb	G 1.000		1.000	-0.001	-0.990**	-0.485**	0.948**						
		P 1.000		1.000	-0.007	-0.760**	-0.446**	0.923**						
4.	No. of stomata / Microscopic field	G 1.000			1.000	-0.009	-0.080	0.142						
		P 1.000			1.000	-0.061	-0.069	0.135						
5.	Length of stomata (µm)	G 1.000				1.000	0.555**	-1.007						
		P 1.000				1.000	0.492**	-0.829						
6.	Breadth of stomata (µm)	G 1.000					1.000	-0.472						
		P 1.000					1.000	-0.455						
7.	Yield of bulb /plant(gm)	G 1.000						1.000						
		P 1.000						1.000						

TABLE 2 : Path analysis at genotypic levels of different quantitative characters for direct and indirect effect

Sr.No.	Characters	No. of Leaves / Plant		Length of Leaves (cm)		No. of Cloves / bulb		No. of stomata / microscopic field		Length of stomata (µm)		Breath of stomata (µm)		Correlation with yields of bulb / plant (gm)
		No. of Leaves / Plant	Length of Leaves (cm)	No. of Cloves / bulb	No. of stomata / microscopic field	Length of stomata (µm)	Breath of stomata (µm)							
01	No. of Leaves / plant	-1.318	-0.317	-0.187	0.049	0.864	-0.062	-0.970						
02	Length of Leaves / plant (cm)	-1.219	-0.340	-0.178	0.070	0.826	-0.068	-0.911						
03	Number of Cloves / bulb	1.237	0.305	0.199	0.000	-0.867	0.074	0.948						
04	No. of Stomata / microscopic field	0.323	0.119	0.000	-0.200	-0.087	-0.012	0.142						
05	Length of stomata (µm)	-1.300	-0.323	-0.197	0.020	0.876	-0.085	-1.007						
06	Breadth of Stomata (µm)	-0.541	-0.153	-0.097	-0.016	0.487	-0.152	-0.472						

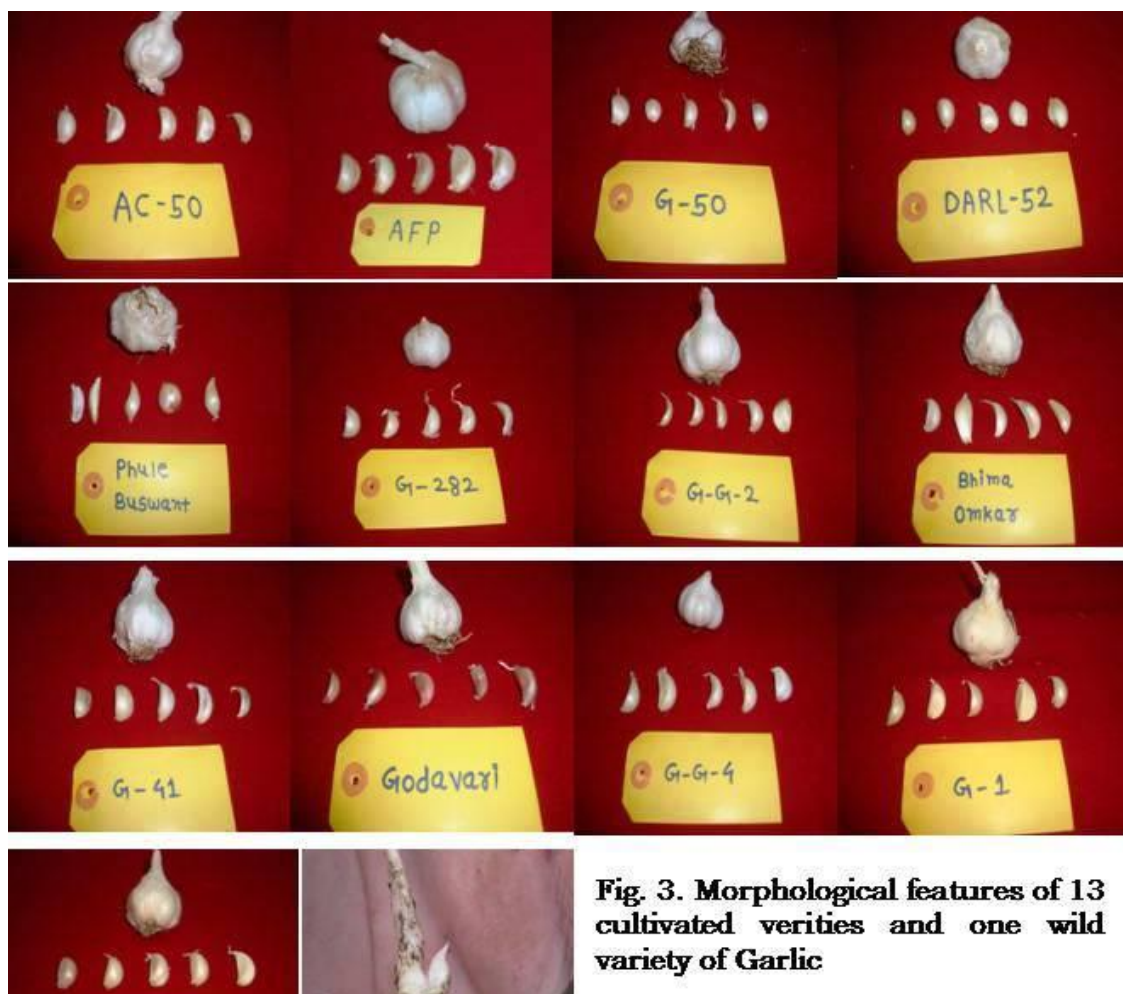


Fig. 3. Morphological features of 13 cultivated varieties and one wild variety of Garlic

CONCLUSION

From the present study it can be concluded that, the character number cloves per bulb had positive and significant correlation with yield / weight of bulb per plant. Path analysis at genotypic level revealed that the length of stomata and number of cloves per bulb had positive direct effect on yield/ weight of bulb per plant. For improvement in yield of Garlic we can give more emphasis on these characters. With respect to flower and pollen study as only wild (mutant) plant produced the flowers and had good amount of pollen fertility percentage it may be used to develop the new garlic varieties producing seed by interspecific hybridization, tissue culture and other improved biotechnological methods.

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