https://doi.org/10.29321/MAJ.10.A02422

Madras Agric. J. 72 (12) : 691—695 December, 1985

GENETIC VARIABILITY AND PATH ANALYSIS IN GARLIC

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Studies on Genetic Variability and Path Analysis of 40 genotypes in garlic revealed that wider variability was present for different traits. The genetic analysis showed that the clove weight and bulb yield per plant registered highest GCV and high heritability coupled with high magnitude of genetic advance indicating additive gene action in those characters. The path analysis also showed that clove weight and highest direct positive effect on bulb yield per plant. Thus the results suggested that the clove weight is the most important character and would serve as good selection index for further improvement of garlic.

Variability for yield and its components is low in a vegetatively propagated crop like garlic (*Allium sativum* L.) and the scope of selection is limited. The efficiency of selection depends mainly on the extent of genetic variability in a population. The yield is complex character depends on several components which are interrelated. A knowledge regarding their mutual relationship and the direction of correlation is necessary. Singh (1981) reported in garlic that clove weight had direct positive effect on bulb weight. Dadlani and Bhagchandani (1978) reported wider genetic variability in onion.

In the present investigation, an attempt has been made to gain an insight into the magnitude of genetic variability and to measure the contribution of various variables to observe correlation and partition the correlation coefficient into components of direct and indirect effects in garlic through biometrical methods.

MATERIALS AND METHODS

The experiment comprising of 40 genotypes of different origin, was laid out in randomized block design with three replications at the Spices Research Station, Pilwai during 1978. The cloves were dibbled at spacing of 15 cm from row to row and 7.5 cm within the row. Plot size was 0.45 x 2.40 m accommedating 3 rows. The fertilizer application and other agro-practices were followed as per general recommendations.

Observations on days to maturity, clove weight (g), number of cloves per bulb, length of clove (cm), girth of clove (cm) and bulb yield per plant were recorded by selecting

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five random plants in each of the replications.

The mean value of all the characters recorded from five randomly selected plants were used for further calculations. Genetic estimates were calculated as per procedure suggested by Johnson *et al.* (1955). Heritability was estimated as a ratio expressed in percentage of genotypic and phenotypic variance. The path analysis was carried out by standard statistical procedure (Dewey and Lu, 1959).

RESULTS AND DISCUSSION

The analysis of variance (Table 1) indicated that the differences between the genotypes in respect of all the traits studied were significant. However, highest variability was recorded for clove weight followed by yield of bulb per plant. Estimates

Table 1. Phenotypic variability in six characters of 40 genotypes in garlic.

Characters	Range of variability	Mean	∓	SE	'F' value
Days to maturity	135.67 - 147.67	141.100	±	2.03	5.454**
Clove weight	0.237 - 1.537	0.744	±	0.05	139.087**
Number of cloves/blub	14.87 - 34.17	22.778	±	0.94	55.880**
Length of clove (cm)	1.707 - 2.898	2.315	±	0.09	34.71**
Girth of clove (cm)	1.257 - 3.693	2.140	±	0.10	99.80**
Bulb yield/plant (g)	6.533 - 25.767	14.295	±	0.52	231.806**

**p=0.01.

Table 2. Variance components, phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV) heritability (H%) and genetic advance expressed as per cent of mean (GA%) in garlic

S. No.	Characters	Variance components		PCV	GCV	H%	GA
		Phenotypic	Genotypic				
1.	Days to maturity	15.34	9.16	2.78	2.15	59.76	4 82
2.	Clove weight (g)	15.84	14.52	53.36	53.06	97.87	9.78
3.	Number of cloves/bulb	25.35	24.02	22.10	21.52	94.82	9.83
4.	Length of clove (cm)	0.38	0.12	16.05	15.38	91.83	0 70
5.	Girth of clove (cm)	0.53	0.51	33.94	33.44	97.05	4.45
6.	Bulb yield/plant (g)	33.99	30.60	38.95	38.69	98.71	11.32

of the genotypic and phenotypic variance (Table 2) revealed that bulb yield per plant exhibited highest phenotypic variance (30.99) and genotypic variance (30.60) followed by number of cloves per bulb. In general, genotypic coefficient of variability (GCV) and phonotypic coefficient of variability (PCV) were of the same magnitude indicating the absence of environmental influence in these characters. Similar findings were earlier reported by Singh (1981) in garlic and by Paramasivan and Rajasekaran (1980) in green gram. However, maximum GCV was recorded for clove weight (53.06) followed by bulb yield per plant. The GCV alone is not sufficient for the determination of amount of heritable variation. But Lerner (1958) have suggested that heritability estimate alongwith genetic advance will be more useful in selecting the best individuals. In the present investigation, it revealed that high heritability was observed for all the traits except length of clove. Such association may be attributed to the action of additive genes (Panse, 1957). Clove weight and yield of bulb per plant showed high heritability and high genetic advance, indicating that the selection may also help in improving these characters

The genotypic and phenotypic correlations are presented in Table 3. In general correlations at genotypic level were slightly higher than those at phenotypic levels indicating that inspite of strong inherent association between various characters studied, the environment may modify the full expression of the genotype (Nandpuri *et al.* 1973). A positive and high correlation of blub yield per plant

Table 3. Genotypic (G) and Phenotypic (P) correlation coefficient among different characters in garlic.

S. No.	Characters		Clove weight	Number of cloves/bulb	Length of clove	Girth of clove	Bulb yield/ plant
1.	Days to maturity	G	0.7189	−0.5584	0.3055	0.6014	0.6207
		P	0.6471	−0.3901	0.1712	0.4722	0.4923
2.	Clove weight	G		−0 6338	0·2358	0.8194	0.8618
		P		−0.6123	0.2344	0.7982	0.8472
3	Number of cloves/ bulb	G			0.0933	−0.2870	−0.2534
		P			0.0696	−0.2685	−0.2418
4.	Length of clove	G				0.2626	0.3767
		P				0.2377	0.3561
5.	Girth of clove	G					0.8678
		P					0.8546

Table 4. Path coefficient analysis for different characters garlic

S. No.	Characters	Days to maturity	Clove Weight	Number of cloves/ bulb	Length of clove	Girth of clove	Correlation coefficient with bulb yield per plant
1.	Days to maturity	*0.0680*	0.6463	—0.2257	0.1674	0.1155	0.6207
2.	Clove weight	0.0489	*0 8989*	—0.2562	0.0129	0.1573	0.8618
3.	Number of clove/bulb	0.0374	—0.5698	*—0.4043*	0.0051	0.0551	0.2534
4.	Length of clove	0.0208	0.2120	0.0377	*0.0548*	0.0504	0.3757
5.	Girth of clove	0.0509	0.7357	—0.1160	0.0144	*0.1920*	0.8678

Figures italic denote direct effect and rest indicate indirect effect.
Residual factor 0.0981.

wtih clove weight, girth of clove, length of clove and days to maturity was recorded. In addition, high and positive intercorrelation was observed between yield components both at genotypic and phenotypic levels except number of cloves with other traits. Thus it can be inferred that selection based on any one of these characters either alone or in combination, will result in identifying the strains having high yield potential. Similar findings are reported by Singh (1981) in garlic and Suthanthirapandian and Muthukrishanan (1980) in onion. Since the mutual relationships of component characters might vary both in magnitude and direction and tend to vitiate the association of bulb yield with attributes it is necessary to partition the genetic correlation into direct and indirec efects of each character.

The path analysis (Table 4) revealed that clove weight had the highest direct positive effect on bulb yield per plant and their indirect effect *via* each other indicated that if other factors are held constant, an increase in these traits will be reflected in an increased bulb yield. The girth of clove and length of clove also had a positive direct effect but of very low magnitude. However, its indirect effect *via* clove weight was positively and high. These results are in agreement with the findings of Singh (1981) and Sree Rangaswamy *et al.* (1980). Conversly, number of cloves per bulb had negative direct effect alongwith negative correlation with bulb yield. The contribution of residual factor accounting for all the characters (0.0981) was negligible.

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Madras Agric. J. 72 (12) : 695—700. December, 1985

EFFECT OF INTERCROPPING, SPACING AND MULCHING IN THE CONTROL OF GROUNDNUT LEAF MINER, *Aproaerema modicella* DEVENTER (GELECHIIDAE : LEPIDOPTERA)

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A field experiment was conducted at Oilseeds Experiment Station, Tindivanam during *kharif* 1983 to study the effect of intercropping, spacing and straw mulching in the control of ground leaf miner. The results indicated that intercropping groudnut with cowpea or blackgram at 3:1 ratio was beneficial in reducing the leaf miner incidence as well as in increasing the income. The paddy straw mulching and adopting closer spacings though reduced the incidence did not fetch increased income.

Part of M. Sc. (Ag.) thesis submitted by the first author to the Tamil Nadu Agricultural University, Coimbatore - 3.

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