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GENETIC VARIABILITY AND GENOTYPE—ENVIRONMENT INTERACTION IN SOME QUANTITATIVE CHARACTERS OF *Arachis hypogaea* L*

M. KANDASWAMI[1], G. SOUNDRAPANDIAN[2] and M. KADAMBAVANASUNDARAM[3]

The genetic parameters Viz., genotypic and phenotypic variations, genotypic and phenotypic coefficient of variation, heritability, expected genetic advance and genetic gain were assessed from 12 varieties of spanish bunch groundnut. The varieties showed significant differences in the mean values for all the characters except for sound mature kernel per cent. Plant height, number of secondary branches, Pod to peg ratio and number of primary branches showed high heritability estimates ranging from 0.80 to 0 96 ; number of mature pods, number of nodes on main stem axis, sound mature kernel per cent, Shelling per cent, harvest index and pod yield showed moderate heritabilty, estimates of 0.45 to 0.62 while low heritability estimates of 0.27 to 0.36 were recorded for weight of mature pods, 100 kernel weight and 100 pod weight. High genotypic coefficient of variation ranging from 11.55 to 41 39 was observed for number of secondary branches plant height and pod yield. Number of secondary branches and plant height, recorded high genetic gain of 82.09 anp 60.57 respectively and the lowest genetic gain of 1.4 was recorded by shelling per cent followed by number of nodes on main stem axis and weight of mature pods (2.04 and 2.44). The genotype environment interaction variance was low for the traits plant height, secondary branches and pod to peg ratio.

Peanut or groundnut is a major oilseed crop of India. To step up production in this crop, breeder's aim at evolving strains which are capable of maximum mean economic yield over environments and consistent in their performance. A critical estimate of genetic variability is a pre requisite. for initiating appropriate breeding procedures in crop improvement, programmmes. The heritable variation is masked by non-heritable components. Hance it is necessary to split the overall heritability using genetic parameters which will enable the breeders to plan suitable breeding strategy. The present investigation was undertaken to estimate the phenotypic variation in groundnut and the heritable components with genetic parameters such as genetic coefficient of variation, heritability estimates and genetic advance.

1. Associate Professor, Reginal Research Station, Vridhachalam-606 001.

2. Professor and Head, Department of Agricultural Botany, Agricultural College and Research Institute, Madurai-625 104.

3. Professor (Cotton), Tamil Nadu Agricultural University, Coimbatore-641 003.

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MATERIALS AND METHODS

Twelve promising bunch groundnut (*Arachis hypogaea* L.) cultures viz., VG 15, VG 18, VG 19, Ah 165/S, Ah 728/S, Ah 8407, Ah 8457, BS 1, BS 4, BS 8, CO 1 and CO 2, in advanced stages of breeding developed at the Agricultural College and Research Institute, Coimbatore and at the Research Stations of the Taminadu Agricultural University situated at Aliyarnagar, Bhavanisagar, Tindivanam and Vridhachalam were raised in eight environments covering different locations, seasons and soil moisture regimes (rainfed and irrigated) The varieties were sown in three row plots of three metre long, with a spacing of 30cm between rows and 10 cm between plants in a randomised block design with three replications. A uniform population was maintained in all the environments, All the required agronomic as well as plant protection measures were adopted as per standard recommendations in each location. Five plants were selected at random for each genotype in each replication and in location for observation.

Genotypic coefficient of variation (GCV) and the phenotypic coefficient of variation (PCV) were calculated by the formula suggested by Burton (1952). Heritability (h^2) in broad sense was worked out adopting the formula of Lush (1940). The Genetic advance was computed using the formula of Johnson *et al.* (1955).

RESULTS AND DISCUSSION

For evolving hihe yielding strains, the plant breeder has to depend upon the economic characters which are quantitatively inherited and are considerably influenced by the environment. Johnson *et al*, (1955) pointed out that genotypic variance estimated on the basisis of a single environment would include variance due to environment interactions and that conclusions based on the inflated estimates of genotypic variance might not hold true at other locations. In the present investigation, which was carried out under eight different environments, the environment exerted significant effect in the expression of characters (Table 1).

The pooled analysis revealed that there were significant environmental effects on all the characters barring sound mature kernel per cent. Apparently the sound mature kernel per cent appear to be least influenced by the differences in environment while all the other traits studied showed variation in their response from one environment to another. Similar findings were reported by Swarnalata *et al.* (1984) in groundnut.

Table 1 : Analysis of variance for mean data of the genotypes in the different environments

		Mean squares												
Source	D. F.	Pl. ht.	No. of primary branches	No. of second branches	No of nodes on main stem axis	Pod to peg ratio	No. of mature pods	Wt. of mature pods	Shelling	Sound mature kernel	100 pod wt.	100 kernel wt.	Harvest index	Pod yield per plot
Genotype	11	3395.64**	0.3287**	1.936**	2.81*	494.71**	9.0**	2.2	22.29	40.46	208.82	32.99	15.59	9992.89
Environment	7	409.02**	0.2756**	0.551**	52.75**	253.34**	76.24**	61.38**	515.50**	557.76	2312.24**	236.24**	285 29**	134326.07**
Genotype x Environment	77	52.17	0.07	0.14	1.26	48:39	3.45	1.42	12.2	378.09	334.13	69.50	66.94	54308.73

**Significant at 1 Per cent level　　*Significant at 5 per cent level.

Table 2 : Components of variances, genotypic and phenotypic coefficients of variation (GCV and PCV), heritability in broad sense (h^2) and genetic advance (GA) for the different traits.

Traits	Phenotypic variance	Genotypic variance	G x E variance	PCV	GCV	h^2(BS)	GA	GA as percentage mean
Plant height	144.42	139.35	16.38	30 47	29.93	0.96	23.77	60.57
Number of primary branches	0.014	0.01	0.01	2 83	2.53	0 80	0.19	4.60
Number of secondary branches	0 083	0.08	0.03	42.92	41.39	0 93	0.65	82.09
Number of nodes on main stem axis	0.117	0 06	0.21	1.40	1 04	0.55	0.39	2.04
Pod to peg ratio	20.613	18.60	13.65	8.70	8.26	0.90	8.42	16.17
Number of mature pods	0 375	0.23	0.35	6 33	4.97	0.62	0.78	8.07
Weight of mature pods	0 092	0.03	0.29	3.36	2.00	0.36	0.22	2.44
Shelling per cent	0.929	0.42	2.12	1 50	1.00	0.45	0.89	1.40
Sound mature kernel (%)	29.82	14.07	123.76	6.91	4.75	0.47	5.29	6.72
100 pod weight	19.14	5.22	107.01	6.02	3.14	0.27	2.43	3.38
100 kernel weight	4.42	1 52	23.07	7.31	4.29	0 34	1.47	5.18
Harvest index	5.05	2.26	21.65	9.23	6.18	0.45	2.07	8.50
Pod yield per plot	4109.36	1846.49	18037.98	17.24	11.55	0.45	59·42	14.71

The phenotypic coefficient of variability ranged from 1.5 for shelling per cent to 42.9 for plant height and the corresponding values for genotypic coefficient of variability were 1 0 and 41.4, respectively (Table 2). The number of secondary branches recorded the highest coefficient of variation. High genetic coefficient of variation observed for number of secondary branches indicated that this trait is much less influenced by environment. The other traits such as plant height, pod yield, pod to peg ratio, harvest index, numbet of mature pods, sound mature kernel per cent and 100 kernel weight showed high coefficient of variation compared to the other characters such as number of primary branches number of nodes on main stem, weight of mature pods, shelling per cent and 100 pod weight. These results were in agreement with the results of Nagabhushanam *et al* (1982). The considerable amount of variation recorded in the different traits in the present study indicated the scope for improving these characters by practising simple selection.

The high heritability recordad for the traits plant height, number of secondary branches, pod to peg ratio, and number of primary branches in the present study showed that these traits might lend themselves for genetic manipulation by adopting mass selection for their improvement. These results were in conformity with the findings of Quadri and Khunti (1982).

Number of mature pods, number of nodes on main stem axis, sound mature kernel per cent, shelling per cent, harvest index and pod yield registered moderate heritability estimate ranging from 0.45 to 0.62 while the low heritability estimates ranging from 0 27 to 0.36 were recorded for weight of mature pods, 100 kernel weight and 100 pod weiget. Low heritability estimates indicates that these characters are hihgly influenced by environment. These characters might be improved by following pureline selection. Sharma *et al* (1984) reported moderate heritability estimate for seed yield in sesamum. The low heritability recorded for weight of mature pods was in agreement with the findings of Sivasubramanian *et. al.* (1977) and Dixit *et. al.* ((1970) in groundnut. The magnitude of heritabiliry indicated that the traits with moderate heritability might respond moderately, while the traits with low heritability might show low response to selection for improvement in these traits.

The high genetic advance recorded for plant height and number of secondary branches in the present study was in agreement with the earlier reports of other workers in groundnut (Dixit *et al.* 1971) and indicated the scope for improving these characters through selection. In order to improve any character high genetic variability and high heritability coupled with genetic advance were considered to be of vital importance. In the present study, the presence of high heritability coupled with high genetic advance was shown by the traits plant height and number of secondary branches. High heritability coupled with high genetic advance as a percentage of mean might point to the predominance of additive gene effects (Panse 1957). Heritability indicates only the effectiveness with which selection of genotype can be based on phenotypic performance, but fail to indicate the genetic progress (Johnson *et al.* 1955). Therefore high heritability does not always mean greater genetic gain.

The number of primary hranches showed a high heritability value of 0.80 and recorded low expected genetic advance of 4.60. High to medium heritability accompanied by medium to low genetic advance recorded for number of primary branches and pod to peg ratio indicated that these traits were conditioned by both additive and non-additive gene effects. The trait pod to peg ratio which showed high heritability estimates of 0.90 recorded moderate genetic advance of 16.17.

High heritability coupled with low genetic advance was observed for number of primary branches per plant and pod to peg ratio. Johnson *et al.* (1955) reported that the genetic gain will be low when there is non-additive gene effects whereas the genetic advance will be high when there is additive gene action. Since these traits were highly heritable it was imperative to practice selection in them to achieve genetic advance. The traits other than pod number per plant were considered to play an important role in determining the yield potential in groundnut. Similar findings were reported by Nagabhushanam *et. al.* (1982).

Moderate heritability coupled with moderate genetic advance was observed for number of mature pods, sound mature kernel per cent, harvest index and pod yield. Dixit *et. al.* (1971) reported moderate heritability coupled with high genetic advance for pod yield. Nodes on main stem axis and shelling per cent which showed moderate heritability estimates registered low genetic advance whereas 100 kernel weight which recorded low heritability showed moderate genetic advance. For the traits that show low genetic advance, single plant selection could be made as suggested by Shandu and Chandra (1969) for the character branching and yield in bengal gram. This finding was in agreement with the findings of Dixit *et. al.* (1971) that high heritability need not always accompany with high genetic advance in groundnut.

The genotypic variance was greater than that due to genotype x environment interactions for plant height, secondary branches and pod to peg ratio while it was equal in the case of primary branches and indicated the low environmental influence on them. Low genotypic environment interaction was considered as the means of varietal adaptation (Allard and Bradshaw, 1964). Chauhan and Shukla (1985), also reported high genetic coefficient of variation for number of branches in groundnut. In the case of traits such as nodes on main stem axis, weight of mature pods, shelling per cent, sound mature kernel per cent, 100 pod weight, 100 kernel weight, harvest index and pod yield the magnitude of interaction components recorded was 3.5, 1.5, 9.7, 5.0, 8.8, 20.5, 15.2, 9.6 and 9.8 times the genotypic variance respectively, indicating the high vulnerability of these traits to the environmental fluctuations.

The closeness between PCV and GCV values observed in respect of the traits plant height number of primary branches, number of secondary branches and pod to peg ratio indicated that these characters were less susceptible to the environmental fluctuations (Dixit *et al.* 1971). This suggested that the least influenced characters could be improved to the extent expected on the basis of an individual environment.

The results indicate that plant height, number of secondary branches, number of mature pods, sound mature kernel per cent. harvest index and pod yield per plot should be given due importance in selection programmes as considerable improvement can be made by genetic manipulation of these traits.

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