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INHERITANCE OF PERIOD FROM SEEDLING EMERGENCE TO FIRST FLOWERING IN PEANUT (*ARACHIS HYPOGAEAL*)

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ABSTRACT

F_1 progenies of peanut (*Arachis hypogaeal.* L.) from a 6×6 diallel, including reciprocals and their parents, were evaluated for the number of days from seedlings emergence to first flower appearance during the 1981 and 1982 rainy seasons at ICRISAT Centre, Patancheru, India. Genetic analysis indicated the predominant role of additive genetic variance in the expression of this character. Genotype 91176 had the best general combining ability for early flowering and has the potential for use in breeding programs. Variety M 13 had the best general combining ability for late flowering.

Key words : Peanut, combining ability, genetic variance, flowering

INTRODUCTION

The period from seedling emergence to first flowering in peanut (*Arachis hypo gaea* L.) is one of the important traits that determines maturity of variety. This trait is potentially useful in formulating an effective breeding strategy in programs where crop duration is of prime concern. There have been very few genetic studies on this character in peanut (Gibori *et al.*, 1978, Parker *et al.*, 1970, and Wynne *et al.*, 1970). The present study was, therefore, undertaken to characterize the nature and magnitude of genetic variance associated with the period from seedling emergence to first flowering in peanut.

MATERIALS AND METHODS

Six peanut genotypes, Chico, 91176 and Dh 3-20 (subsps. *fastigiata* var *vulgaris*), Gangapuri (subsps. *fastigiata* var *fastigiata*), and Robut 33-1 and M 13 (subsps. *hypogaea* var. *hypogaea*), were chosen for this study. Chico, 91176 and Gangapuri flower at the same time but Gangapuri takes a little longer to reach maturity than the other two genotypes. Dh-3-20 flowers later than Chico and 91176 but is similar to Gangapuri in maturity. In the subsps. *hypogaea* group ,the variety Robut 33-1 flowers and matures earlier than M 13 which takes about a month to flower and has a longer maturity period.

The genotypes were crossed in a diallel mating system that included reciprocals. Thirty F_1's and six parents were sown in a randomized block design with two replications in the rainy seasons (June-October) of 1981 and 1982 at ICRISAT Research Cente Patancheru, India. Each plot had a signle row of ten plants spaced 15 cm apart on 75 cm ridges. Five competitive plants within a row were randomly selected and used to record observations on days to first flowering.

Data were analyzed on a plot mean basis following combining ability analysis, method 1, model 1 (Griffing ,1956) and the graphical and component analyses of Hayman (1954) and Jinks and Hayman (1953).

RESULTS AND DISCUSSION

In both years significant genotypic differences for the period from seedling emergence to first flower production were observed among the parents and the crosses (Table 1). Mean squares due to general combining ability (GCA), specific combining ability (SCA), and reciprocal effects (REC) were highly significant for this character in both years (Table 2). The estimated variance due to GCA was twice the variance of SCA in 1981, and five times greater in 1982. Although the magnitude of the variance component of combining ability varied with years, possibly due to genotype × environment interactions, the predominance of GCA variance was evident in both years. Variance dueto REC, though significant, was small compared to GCA variance. Component analysis also revealed the predominance of additive genetic variance in both years. However, the variance estimates of the additive effect of genes (D) varied over years, being higher in 1982 (Table 3). Earlier reports on combining ability studies for days to flower in F_1 progenies of a 6×6 diallel cross in peanut, evaluated under phytotron and field conditions, also revealed the predominance of additive genetic variance (Parker *et al.*, 1970 and Wynne *et al.*, 1970).

The best general combiner for early flowering in both years was the genotype 91176, followed by Gangapuri, Chico, the earliest flowering genotype, was third (Table 4). Chico has been used extensively in breeding programs as a source of earliness, but its combining ability has not been determined previously. Genoytpe 91176, with a similar flowering period to Chico, and with better combining ability has been used little in breeding programs. Similarly, M 13, followed by Robut 33-1, was the best general combiner for late flowering and could be used to develop high yielding, late maturing peanut varieties. Highly significant positive correlation (r=0.94 in 1981 and 0.97 in 1982) between the *per se* performance of the parents and their crosses indicates that cross performance can be predicted based on the performance of parents involved in a cross. Genotype 91176, although early in flowering, has a low yield potential and small seeds, whereas M 13 is a late flowering, large seeded variety with a high yield potential. Transgressive segregants combining early flowering and large seed type with high yield potential might be recovered from an F_2 populations of a cross between these two genotypes.

The nonsignificant t^2 value in both years (1.18 in 1981 and 0.06 in 1982) indicated the fulfilment of the assumptions of the diallel analysis. The regression of covariance (Wr) on variance (Vr) also did not deviate significantly from unity, which further proved the adequacy of the additive dominant model in this material. The regression line intercepts the Wr axis above the origin, indicating partial dominance in both years. The distribution of array points revealed that both early flowering genotypes, Chico and 91176, possessed an excess of recessive alleles. However, Gibori *et al.*, (1987) reported an excess of dominant alleles in Chico for this trait in the F_2 generation. Dominant and recessive alleles controlling late flowering in M 13 were observed to be of a differential nature; with an excess of recessive alleles in 1981 and of dominant alleles in 1982. This particular observation is similar to those on oil content in flax reported by Yermanos and Allard (1961) indicating that identical genotypes can exhibit different typese of gene action when grown in different environments.

These results and those reported earlier indicate the importance of additive genetic variance in controlling the flowering period from seedling emergence to first flower production in peanut. Genotype 91176 and M 13 were the best general combiners for early and late flowering periods, respectively.

LITERATURE CITED

GIBORI, A., HILLEL J., CAHENER, A., and ASHRI A. (1978). A 9X9 diallel analysis in peanut Flowering time, top weight, pod yield per plant and pod weight. Theor. Appl. Genet. **53**: 169–179.

GRIFFING, B. (1956). Concept og general and specific combining ability in relation to diallel crosisng systems. Australian J. Biol. Sci. **9**: 463–493.

HAYMAN, B.I. (1954). The theory and analysis of diallel crosses. Genetics **39**:789–809.

JINKS, J.L., and HAYMAN, B.I. (1953). The analysis of diallel crosses. Maize Genetics Coop. News. **27**:48–54.

PARKER, R.C., WYNNE, J.C., and EMERY, D.A. (1970). Combining ability estimates in *Arachis hypogaea* L. I. F_1 seedling responses in a controlled environment. Crop Sci. **10**:429–432.

WYNNE, J.C., EMERY D.A., and RICE, P.W. (1970). Combining ability estimates in *Arachis hypogaea* L. II. Field performance of F_1 hybrids. Crop Sci. **10**:713–715.

YERMANOS, D.M., and ALLARD, R.W. (1961). The detection of epistasis gene action in flax. Crop. Sci. **1**:307–310.

TABLE 1. Analysis of variance of parents and F_1 progenies for days to first flowering from seedling emergence in peanut, rainy seasons 1981 and 1982 ICRISAT Center.

Sources	df.	Mean sum of squares	
		1981	1982
Replications	1	0.01	1.61
Treatments	35	330.73**	356.28**
Parents	5	1269.54**	1336.29**
Crosses	29	3.24**	10.98**
Parents vs. Crosses	1	5134.00**	5469.80**
Error	35	0.34	0.69

** Significant at 0.01 probability level.

* *Parents* P1 = Chico; P2 = 91176; P3 = Dh 3-20; P4 = Gangapur; P5= Robut 33-1; P6 = M 13

TABLE 2. Analysis of variance for components of combining ability for days to first flowering from seedling emergence in peanut, rainy seasons 1981 and 1982 ICRISAT Centre.

Sources	df	Mean sum of squares	
		1981	1982
GC*A*	5	13.61**	38.88**
SCA	15	0.77**	0.97**
REC	15	0.54*	0.95**
Error	35	0.17	0.34
Var (GCA)		1.12	3.21
Var (SCA)		0.60	0.63
Var (REC)		0.18	0.30

** Significant at 0.01 probability level

GCA — General combining ability;

SCA — Specific combining ability;

REC — Reciprocal effects;

Var (GCA) — Variance due to general combining ability;

Var (SCA) — Variance due to specific combining ability;

Var (REC) — Variance due to reciprocal effects.

TABLE 3. Components of gënetic variance for days to first flowering from seedling emergence in peanut rainy seasons 1981 and 1982 ICRISAT Centre.

Components	1981		1982	
D	7.89**	+ 0.62	11.73**	+ 0.25
H_1	2.57	+ 1.68	-1.29	+ 0.63
H_2	1.18	+ 1.52	-1.22	+ 0.68
h^2	0.05	+ 1.02	0.57	+ 0.41
E	0.17	+ 0.23	0.35	+ 0.01

** Significant at 0.01 probability level

D — Additive genetic variance;

H_1 — Nonadditive genetic variance due to dominance effects of genes;

H_2 — Proportion of nonadditive variance due to positive and negative effects of genes;

h^2 — Net dominance effects;

E — Variance due to environmental effect.

TABLE 4. ***Per se*** **performance of the parents and general combining ability effects for days to first flowering from seedling emergence in peanut, rainy seasons 1981 and 1982 ICRISAT Centre.**

Parents	1981		1982	
	Per se performance	GCA Effects	*Per se* performance	GCA Effects
91176	20	-1.14*	20	-1.54**
Gangapuri	20	-0.94*	21	-1.23**
Chico	20	-0.32*	20	-0.98**
Dh 3-20	23	-0.09	22	-0.51*
Robut 33-1	24	0.89*	26	1.18**
M 13	27	1.60*	29	3.10**
SE gi		0.11		0.15
SE gi-gj		0.17		0.24

* and ** Significant at 0.05 and 0.01 probability level, respectively.

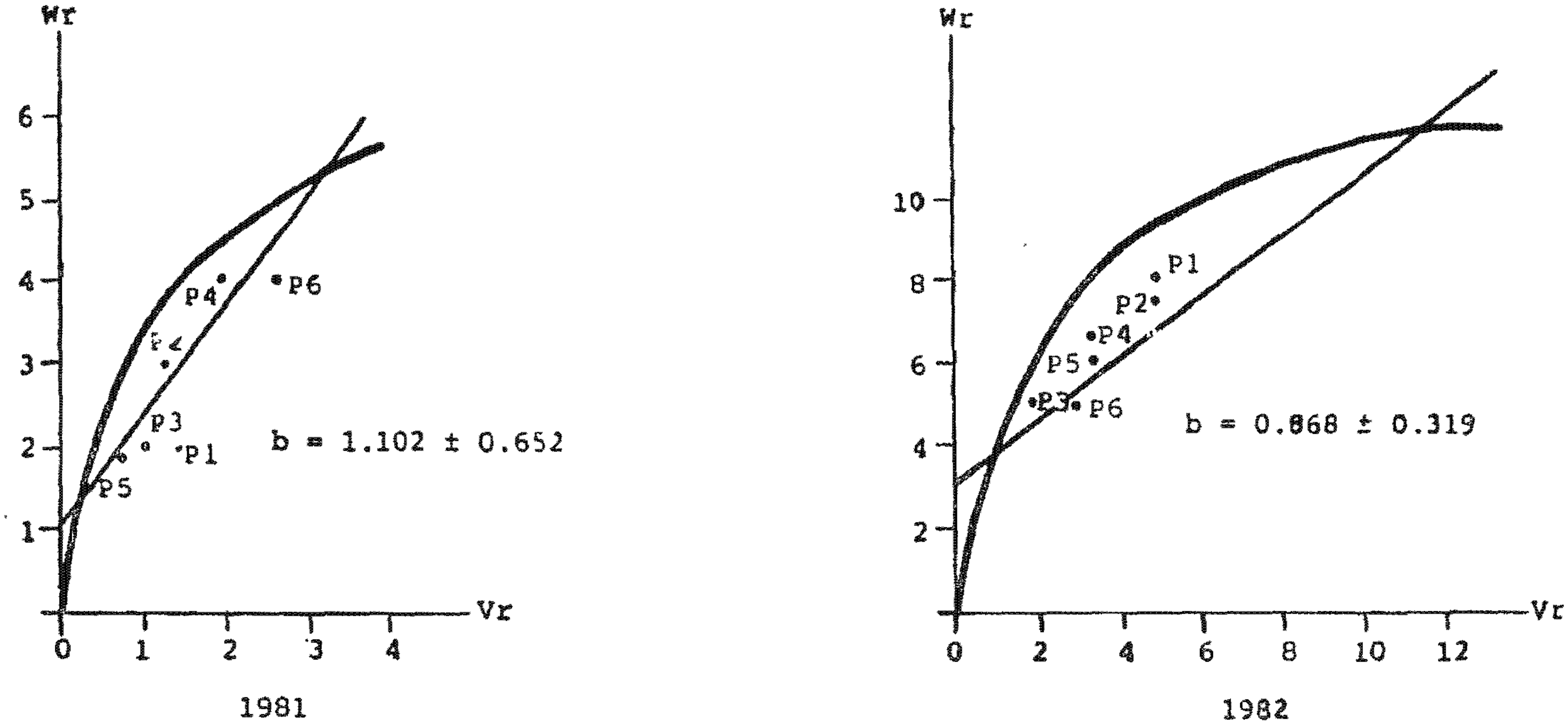

Fig. 1: Covariance (Wr), Variance (Vr) graph for days to first flowering from seedling emergence, rainy seasons 1981 and 1982.