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INHERITANCE OF FIVE MORPHOLOGICAL TRAITS IN GROUNDNUT

T. RADHAKRISHNAN, T.G.K. MURTHY AND P. SEN
National Research Centre for Groundnut, Junagadh 362 015, India

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SUMMARY

The inheritance of 5 morphological characters was analysed using 3 cross combinations. Plant size was found to be governed by a single gene with short type being recessive. The anthocyanin pigmentation of leaf venation and garnet colour of standard petal were controlled by 2 complementary genes, and corduroy leaflet surface by duplicate recessive genes. The intensity of green colour of foliage seemed to be controlled by 2 loci, *Chl 1 chl 1, Chl 2 chl 2* with additive complementary effects. The inheritance of pigmentation of venation and flower colour was reported for the first time in groundnut.

Key Words : Groundnut, morhological traits, inheritance

INTRODUCTION

Since 1910, the inheritance of several traits in groundnut has been reported (see Wynne & Coffelt 1982, Reddy 1988). *Arachis hypogaea L.* is a stabilized allotetraploid and has been reported to have two genomes, A and B (Smartt et al. 1978). Hence, most of the qualitative characters have been reported to be controlled by at least duplicate genes, (Wynne & Coffelt 1982). In this paper, an account on inheritance of 5 morphological traits has been presented.

MATERIALS AND METHODS

The characteristic features of the parents involved in different crosses were as follows :

Chico : Dwarf (15 cm in height), light green colour of foliage, and small pod size (1 to 2 cm long and 0. 5 to 0. 7 cm broad)

BAU 12 : Normal plant height (30 to 35 cm), dark green foliage, bold pods (3 to 4. 5 cm 1 x 2 to 2. 5 cm b)

L-24 : Green colour of leaf venation, orange colour of standard petal

GCAc 927 : Red-purple venation, garnet colour of standard petal

TG 2 : Normal leaflet surface

Tetraploid (J 11 x *A. duranensis*) hybrid : Normal leaflet surface

Eight cross combinations were attempted in *Kharif* 1988 and 1989 between cultivars with contrasting features for determining the inheritance of 5 morphological traits.

The F_1 hybrids were space-planted to obtain high pod number. The F_2 generation was grown in *Kharif* 1989 and 1990. The segregation of different traits was recorded on per plant basis and the ratios were fitted to expected genetic ratios using chi-square

test. The number of segregating populations were noted in the F_3 generation for testing the validity of the conclusions made in the F_2.

RESULTS AND DISCUSSION

1. Plant size

The reciprocal cross Chico x BAU 12 resulted in F_1 hybrids having normal plant size, indicating that dwarf is recessive in nature. The χ^2-value for the F_2 ratios in the reciprocal crosses showed a good fit to a monogenic 3:1 ratio for normal versus dwarf plants (Table 1). This conforms to the observations of Patil & Mouli (1975) The F_3 populations from the dwarf plants did not segregate for normal plants, also confirming the monogenic recessive nature of the dwarf plant size. The symbol *Dw dw* is proposed for the locus governing the plant size in groundnut.

2. Pigmentation of leaf venation

The hybrids of the reciprocal cross J L 24 x NCAc 927 showed pigmentation of veins although the pigment was lighter than in NCAc 927. The segregation of plants with purple-red and those with green colour of venation was in agreement with the expected F_2 ratio of 9 : 7. The F_2 plants without pigmentation of veins bred true for the trait in F_3 [Table 1]. These observations confirmed the digenic complementary nature of inheritance of pigmentation of leaf venation in this cross. Genetics of this character was not reported previously in groundnut. The gene symbols *Pig1 pig1* and *Pig 2 pig2* have been proposed for the two complementary loci governing anthocyanin pigmentation of leaf venation in groundnut. The trait is useful as a marker in identification of hybrids at very early stages of development.

3. Colour of foliage

Light green foliage of 'Chico' was found to be dominant to dark green colour in BAU 12, as observed in the F_1 hybrids. In F_2, the segregation of plants with light green and green foliage showed a good fit to the expected digenic ratio of 11:5 (Table 1). The dark green F_2s bred true, whereas the light green ones gave rise to F_3 populations segregating as well as nonsegregating for the trait. Thus it seemed that at least two dominant alleles of one of the two loci *Chl 1 chl 1* and *Chl 2 chl 2* or one dominant allele each at both the loci are necessary for the regulation of chlorophyll production (by perhaps some other independent locus or loci). The previous studies on the foliage colour reported that dark green colour of leaflets is either monogenic or digenic dominant to light green colour (Badami 1923, Datal 1962, Balaiah et al. 1977). Therefore, a different genetic mechanism seems to operate in this cross.

4. Corduroy leaflet surface

The tetraploid interspecific hybrid cv J 11 x *A. duranensis* was backcrossed as a male to a high yielding cultivar GG 2 for introgression of disease resistance genes from *A. duranensis* to *A. hypogaea* background. The parents as well as the BC_1 F_1 hybrids had smooth leaflet surface. But the BC_1 F_2 generation segregated for plants

TABLE 1 : Segregation data for F_2 progenies and F_3 families from different crosses for 5 morphological traits in groundnut

Cross	Segregation in F_2	Total	χ^2	F_3 families (NS and SG) F_2 phenotype	No. of F_3 families
1. Plant size					
Chico (S) x BAU 12 (N)	191 N 73 S	264	0.99 (3:1)	S	30 S
BAU 12 x Chico	66 N 24 S	90	0.13 (3:1)	–	–
2. Foliage colour					
Chico (LG) x BAU 12 (DG)	181 LG 87 DG	268	0.29 (11:5)	DG	35 DG
3. Colour of venation					
JL 24 (G) x NCAc 927 (PR)	139 PR 83 G	222	3.65 (9:7)	G	All G
4. Corduroy leaflets					
GG 2 (N) x (J 11 x *A. duranensis*)	176 N 11 C	187	0.05 (15:1)	C N	11 C 40(NS)+92(SG)
	52 N 4 C	56	0.08 (15:1)		
5. Flower colour					
JL 24 (OR) x NCAc 927 (GA)	40 GA 33 OR	73	0.06 (9:7)	OR	30 OR

N–normal ; S–dwarf ; LG–light green ; DG–dark green ; PR– purple red ; OR–orange ; GA—garnet ; NS–nonsegregating : SG– segregating ; χ^2–nonsignificant at 5% level

with normal leaflets and mutants with corduroy leaflets (the leaflets had ribbed parellel lateral veins, assuming the surface akin to that of a corduroy fabric). The phenotypic ratios of two large BC_1 F_2 families were analysed and the segregation of normal and the corduroy mutants gave a best fit to the expected F_2 ratio of 15:1. This indicated that corduroy leaflets are governed by duplicate recessive genes. The BC_1 F_3 families grown from selfed BC_1 F_2 normal plants contained both segregating and nonsegregating progenies in the expected ratio 7:8 (Table 1). The gene symbols *Cor 1 cor 1* and *Cor 2 cor 2* have been assigned for the two loci governing corduroy leaflets. Since both the parents involved in the backcross were observed to breed true for smooth leaflet surface, it is assumed that these genotypes had one of the duplicate recessive loci. The duplicate recessive nature of X-ray induced corduroy mutants was reported previously by Loesch & Hammons (1968).

5. Colour standard petal

The garnet colour of standard petal in line NCAc 927 was dominant to the orange flower in JL 24. In F_2, the segregation ratio of plants with garnet flowers and those with orange colour of flowers gave a good fit to the expected digenic complementary ratio of 9 : 7. All the F_2 plants bearing orange flowers bred true and those with garnet flowers gave rise to F_3 populations segregating and nonsegregating for the trait. This is the first report on the inheritance of garnet colour of standard petals in groundnut. The complementary genes responsible for garnet colour are designated as *Gfl 1 gfl 1* and *Gfl 2 gfl 2*. The trait is useful as a genetic marker in identification of F_1 hybrids.

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