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INHERITANCE OF ALBINISM IN CERTAIN INTERSPECIFIC AND INTERSUBSPECIFIC CROSSES IN GROUNDNUT (*ARACHIS HYPOGAEA* L.)[1]

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INDEX WORDS

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SUMMARY

A study of the several interspecific and inter-subspecific crosses indicated that albinism in groundnut is recessive and in these crosses is controlled by triplicate recessive loci.

INTRODUCTION

Chlorophyll deficiency or albinism is an undesirable character often observed in segregating generations of interspecific crosses in groundnut. Genetic studies based on F2/F3 data from a limited number of crosses studied by earlier workers indicated that this character is recessive and is controlled by duplicate (PATEL et al., 1936; HULL, 1937 and KATAYAMA & NAGATOMO, 1963) or triplicate genetic factors (BADAMI, 1928). These workers recorded only two classes – normal plants and albinos in the segregating generations. However, COFFELT & HAMMONS (1971) reported that albinism was trigenic with three classes (60 green: 3 albino: 1 zygotic lethal), chlorophyll formation being controlled by duplicate loci interacting epistatically with another locus and homozygous triple recessive alleles causing zygotic lethality.

MATERIALS AND METHODS

At ICRISAT a large number of interspecific and intersubspecific crosses are made to produce high yielding genotypes with resistance to diseases, pests and other stress factors. The numbers of green plants and albinos were recorded in thirty-nine F2 populations of such crosses within a week after emergence during the 1981–1982 post-rainy season to determine the inheritance of albinism.

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RESULTS AND DISCUSSION

Table 1 and 2 give the Chi-square values for all three F2 ratios studied for albinism in interspecific and intersubspecific crosses, respectively. The Chi-square value for the 15:1 genetic ratio was highly significant in all the crosses except F334A-B-14 × Exotic 3–5. However, for the 60:3 ratio, which is derived from the 60:3:1 trigenic ratio, only six out of 39 crosses showed a good fit to this model. The individual Chi-square value in 33 cross combinations was significant indicating the failure of the 60:3 ratio for albinism. The total and pooled Chi-square values for the 15:1 and 60:3 ratios were

Table 1. Chi-square tests for different digenic and trigenic ratios of F2 plants segregating for normal vs. albino seedlings in interspecific crosses.

Pedigree	Frequency of F2 phenotype		χ^2 values		
	green	albino	63:1	60:3[a]	15:1
ICGS 3 × NC Ac 2232	172	4	0.57	2.39	4.75*
ICGS 7 × NC Ac 2232	370	11	4.34*	2.95	7.35**
ICGS 10 × NC Ac 2232	1236	11	2.21	41.38**	57.84**
ICGS 15 × NC Ac 2232	297	3	0.61	9.36**	19.11**
Jacana × NC Ac 2232	576	6	1.07	17.86**	27.05**
TMV 7 × NC Ac 2232	629	6	1.57	20.40**	30.50**
72-R × NC Ac 2232	298	6	0.33	5.21*	9.48**
J 11 × NC Ac 2242	236	7	2.74	1.89	4.71*
ICGS 2 × NC Ac 2214	437	10	1.32	6.28*	12.28**
ICGS 3 × NC Ac 2214	845	19	2.27	12.51**	24.19**
ICGS 7 × NC Ac 2214	292	8	2.37	2.91	6.57*
ICGS 13 × NC Ac 2214	206	3	0.02	5.09*	8.26**
ICGS 14 × NC Ac 2214	186	2	0.30	5.66*	8.62**
ICGS 22 × NC Ac 2214	156	1	0.87	5.89*	8.44**
M 13 × PI 337409	313	8	1.80	3.65	7.73**
Shulamit × PI 337409	284	6	0.48	4.64*	8.65**
TMV 10 × PI 337409	497	9	0.15	9.93**	17.26**
F334A-B-14 × PI 337394F	1164	22	0.66	22.10**	39.09**
Shulamit × PI 337409F	276	3	0.43	8.36**	12.75**
ICGS 6 × UF 71513-1	738	8	1.16	22.38**	34.13**
ICGS 19 × UF 71513-1	901	11	0.75	25.48**	39.59**
G201 × UF 71513-1	245	5	0.31	4.20*	7.70**
Kanyama × UF 71513-1	303	3	0;67	9.65**	14.50**
M-13 × UF 71513-1	471	9	0.30	8.82**	15.68**
NC Ac 17352 × UF 71513-1	660	8	0.58	18.71**	29.10**
Shulamit × UF 71513-1	195	2	0.38	6.09*	9.21**
F334A-B-14 × Exotic 3–5	137	4	1.48	1.15	2.80
M-13 × Exotic 3–5	623	4	3.48	23.51**	33.70**
Shulamit × Exotic 3–5	197	2	0-40	6.19*	9.34**
Total (29df)	–	–	33.62	314.64**	505.38**
Pooled (1df)	12940	201	0.09	302.74**	499.73**
Heterogeneity (28df)	–	–	33.53	1.19	5.65

[a] Derived from 60:3:1 ratio.

* and ** Significant at P = 0.05 and 0.01, respectively.

Table 2. Chi-square tests for different digenic and trigenic ratios of plants segregating for normal vs. albino seedlings in intersubspecific crosses.

Pedigree	Frequency of F2 phenotype		χ^2 values		
	green	albino	63:1	60:3[a]	15:1
L. No. 95A × PI 337409	1263	18	0.20	31.82**	51.81**
L. No. 95A × PI 337394F	901	16	0.19	18.41**	31.76**
ICGS 1 × UF 71513-1	742	11	0.05	18.09**	29.47**
ICGS 11 × UF 71513-1	638	12	0.34	12.18**	21.51**
ICGS 12 × UF 71513-1	733	8	1.12	22.15**	33.80**
ICGS 16 × UF 7113-1	713	10	0.15	18.20**	29.22**
ICGS 24 × UF 71513-1	696	12	0.08	14.68**	25.07**
Golden 1 × UF 71513-1	828	15	0.25	16.53**	28.75**
L. No. 95A × UF 71513-1	779	10	0.44	21.24**	33.43**
L. No. 95A × Exotic 3–5	790	10	0.51	21.76**	34.13**
Total (10df)	–	–	3.33	195.09**	318.45**
Pooled (1df)	8083	122	0.30	194.04	317.69**
Heterogeneity (9df)	–	–	3.03	1.04	0.76
χ^2 value including all the interspecific and inter-subspecific crosses:					
Total (39df)	–	–	36.95	509.73**	823.83**
Pooled (1df)	21023	323	0.34	496.78**	817.41**
Heterogeneity (38df)	–	–	36.61	12.95	6.42

[a] Derived from 60:3:1.
* and ** Significant at P = 0.05 and 0.01, respectively.

highly significant both for interspecific and intersubspecific crosses, which further indicated an overall unsatisfactory fit for either of these two genetic ratios in these crosses. However, when these crosses were analysed for the 63 green:1 albino F2 ratio, the individual Chi-square values were nonsignificant for all the crosses except ICGS 7 × NC Ac 2232. Whereas the Chi-square value for this cross was higly significant with the 15:1 ratio, it was non-significant for the 60:3 ratio, which indicated that this cross satisfactorily fitted the three gene model. The total and pooled Chi-square values in both cases i.e. among the interspecific and intersubspecific crosses were also nonsignificant indicating a good fit to the 63:1 genetic ratio. The Chi-square values for all the three F2 ratios were nonsignificant for F334A-B-14 × Exotic 3–5. However, it was lower for the trigenic model (i.e. 60:3 or 63:1) than for the digenic ratio. This showed the failure of the 15:1 genetic ratio in this cross. The total and pooled Chi-square values from all thirty-nine crosses were highly significant for the 60:3 and 15:1 F2 ratios whereas the 63:1 F2 ratio had a good fit at the 0.01 probability level.

Since albinism in other crosses involving either of these parents were not studied, it is not possible to group these cultivars for their genetic constitution for albinism. However, with the trigenic model and on the assumption that three non-allelic homozygous loci control the expression of this trait, albino seedlings in F2 generation can only be observed when genotypes with two non-allelic recessive loci (i.e. AAbbdd,

aaBBdd and aabbDD) are crossed with the genotype that have a recessive allele for the three loci (i.e. aaBBDD, AAbbDD & AABBdd).

Our results based on a large number of F2 populations varying in size from 141 to 1281 plants show that albinism in groundnut is recessive in nature and is controlled by triplicate recessive factors. The present study and those reported by earlier workers (COFFELT & HAMMONS, 1971 and PATEL et al., 1936) revealed that albino seedlings are frequently found in wide, interspecific crosses. Intersubspecific crosses, as in the present study, have also yielded albino seedlings in the F2 generation and have shown a good fit to the 63:1 ratio.

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