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Genetic control of seed coat texture in cowpea, *Vigna unguiculata* (L.) Walp.

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ABSTRACT

Genetic control of seed coat texture was investigated in F_2 and backcross populations involving seven accessions of cowpea (*Vigna unguiculata* (L.) Walp). In two of the four crosses, the seed coat texture was found to be under monogenic inheritance. In the other two crosses, the trait was found to be controlled by two genes with complementary effect, giving a segregation ratio of 9 smooth : 7 rough for F_2 and 1 smooth : 3 rough for backcross generations.

Key Words: cowpea, seed coat texture, complementary gene action, segregation, backcross, *Vigna unguiculata.*

INTRODUCTION

Cowpea, *Vigna unguiculata* (L.) Walp is an important grain legume crop in the tropical and sub-tropical regions of the world. It is of major importance to the livelihood of millions of relatively poor people in comparatively less developed countries of the tropics. In Nigeria, it is the most important source of plant protein with a high protein content of 20-25% (Stanton *et al.* 1966). One of the major problems of cowpea has been its low yield and efforts are being made to raise its productivity and quality. One of the main factors that determine the consumer acceptability of cowpea is the texture of the seed coat. Most consumers prefer the seed with rough coat texture because it cooks faster than the seed with smooth coat. Hence, understanding the mode of genetic control of this character in order to formulate appropriate breeding strategies is important.

Rawal (1975) and Rajendra *et al.* (1979) reported single gene inheritance for seed coat texture with smooth seed coat dominant to wrinkled/rough seed coat. Fery (1985) proposed the symbol Pc for this single gene. However, the behaviour of some lines in crosses made during a breeding programme was not in accordance with reports by earlier workers. It was then suspected that genetic control of this trait might not be the same in different accessions of cowpea. This study was therefore undertaken to investigate the nature of the genetic control of seed coat texture in a number of cowpea lines.

MATERIALS AND METHODS

Seven cowpea lines were used for the study. The names, sources and seedcoat types of these lines are presented in Table 1. These lines have been maintained through several generations by selfing. However, to confirm that these lines were homozygous, an evaluation study was carried out in the green house at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria.

Each line was planted in twenty plastic pots with two plants per pot. The plants were maintained to maturity and no segregation was observed. Their seeds were collected for use in hybridization. These lines were then combined in the following crosses:

IBPC x IT82E-9	(P_1 x P_2)
IBPC x IBS 876	(P_1 x P_5)
Ife BPC x TVu 4578	(P_3 x P_4)
R10028 x G2497	(P_6 x P_7)

Crosses to produce F_1s and backcrosses to respective parents were made in the green house. The methods used were those described by Zary and Miller (1982). To produce F_2 seeds, a portion of the F_1 seeds was sown in the field. Seeds from each cross were planted into two rows with a spacing of 30cm within row and 50cm between rows. F_2 seeds were harvested from the F_1 plants and fumigated in containers with phostoxin against storage pests until they were planted. Field evaluation of Parent 1, Parent 2, F_1, backcross to parent 1, backcross to parent 2 and F_2 generations for each cross was done during the dry season at IITA, Ibadan, Nigeria. The field was irrigated once a week for 8-hours throughout the growing period. A randomized

complete block design with four replications was used. At maturity, when the pods had dried, the pods from each plant were harvested separately into a seed bag and labelled according to the plant identification number. Each plant was given a replication number, a row number and a within-row number. The seeds were visually scored into distinct classes of smooth and rough. The F_2 and backcross to parents data were tested for their goodness-of-fit to appropriate genetic ratios by the Chi-square method (Gomez and Gomez 1984).

RESULTS AND DISCUSSION

The results of the four crosses analysed to study seed coat texture are presented in Table 2. Parental lines P_1, P_3, and P_7 had rough seed coats while lines, P_2, P_4, P_5 and P_6 had smooth seed coats (Table 1). The F_1 progenies of crosses $P_3 \times P_4$ and $P_6 \times P_7$, had smooth seed coats and when they were backcrossed to the rough-seeded parents, a 1 smooth: 1 rough ratio was obtained. The F_2 families of these crosses showed a segregation of 3 smooth: 1 rough, suggesting single gene inheritance of seed coat texture in these lines.

In crosses $P_1 \times P_2$ and $P_1 \times P_5$ all F_1 offspring had smooth seed coats but when backcrossed to P_1 (the rough seeded parent), a 3 rough: 1 smooth ratio was obtained. Chi-square tests of the F_2 families gave a good fit to the 9 smooth: 7 rough modified digenic inheritance ratio (Table 2).

Thus, the results of the inheritance study for seed coat texture showed clear inheritance patterns. The monogenic inheritance pattern observed in crosses $P_3 \times P_4$ and $P_6 \times P_7$ agree with the findings of Rajendra *et al.* (1979). They reported a single gene inheritance for seed coat texture. However, results of the crosses $P_1 \times P_2$ and $P_1 \times P_5$ indicated that the trait is controlled by two complementary genes. Franckowiak (1973) and Rawal (1975) reported rough testa texture to be controlled by at least two recessive genes and they recognised seed coat texture to be of vital importance in cowpea improvement. Therefore, it can be concluded that the genetic control of seed coat texture in some cowpea lines is controlled by two genes with complementary effects.

Table 1. Names, sources and seed coat types of lines used in the study.

Name	Source*	Code Number	Seed Coat Type
IBPC	1	P_1	Rough
IT82E-9	2	P_2	Smooth
Ife BPC	3	P_3	Rough
TVu 4578	2	P_4	Smooth
IBS 876	1	P_5	Smooth
R 10028	1	P_6	Smooth
G 2497	1	P_7	Rough

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Table 2. Number of observed plants having different seed coat textures in parents and crosses of smooth and rough seeded lines of cowpea and the tests for goodness-of-fit to expected ratios.

Cross and Generation	Observed Number of plants Smooth	Rough	Total	Expected Ratio	χ^2	Probability (P)
Ife BPC x TVu-4578						
Ife BPC (P_3)	-	72	72			
TVu 4578 (P_4)	68	-	68			
F_1	95	-	95			
Ife BPC x F_1	129	126	255	1:1	0.035	0.75<p<0.90
TVu 4578 x F_1	137	-	137			
F_2	714	245	959	3:1	0.153	0.50<p<0.75
R10028 x G2497						
R10028 (P_6)	90	-	90			
G2497 (P_7)	-	78	78			
F_1	71	-	71			
G2497 x F_1	61	63	124	1:1	0.032	0.75<p<0.90
R10028 x F_1	380	-	380			
F_2	724	239	963	3:1	0.016	0.90<p<0.95
IBPC x IT82E-9						
IBPC (P_1)	-	20	20			
IT82E-9 (P_2)	62	-	62			
F_1	55	-	55			
IBPC x F_1	67	203	270	1:3	0.004	0.90<p<0.95
IT82E-9 x F_1	120	-	120			
F_2	451	331	782	9:7	0.643	0.25<p<0.50
IBPC x IBS 876						
IBPC (P_1)	-	42	42			
IBS 876 (P_5)	65	-	65			
F_1	70	-	70			
IBPC x F_1	70	210	280	1:3	0.000	>0.99
IBS876 x F_1	190	-	190			
F_2	355	270	625	9:7	0.077	0.75<p<0.90

- Indicates no plants.

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