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Inheritance of Stripe Pattern on Fruits and Seed Colour in "Egusi" Melon, *Colocynthis Citrusllus L.*

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ABSTRACT

The inheritance patterns of stripes on fruits and seed colour were investigated using F_1, F_2 and F_3 populations from crosses involving three varieties of "egusi" melon, *Colocynthis citrullus L.* The three varieties used were "Sewere" (S), "Barablack edge" (BB) and "Barawhite edge" (BW). They were crossed in all possible combinations including their reciprocals. Results obtained indicate that pattern of stripe on fruits is controlled by a single gene pair while seed colour is controlled by two genes (dihybrid inheritance). Chi-square analysis of the data showed a good fit between observed and expected ratios in all the populations.

KEYWORDS: Inheritance patterns, fruit stripes, seed colour, *Colocynthis citrullus.*

INTRODUCTION

C. citrullus is an important source of oil and protein in the diet of most Nigerians (Joda *et al.*, 1996). The ground seeds, which contain 46% oil and 36% protein (Purseglove, 1991) form a major soup ingredient in West Africa. It is also an important cash crop in this region. In spite of this, not much is available in literature on the inheritance patterns of important traits in this crop. Even though some breeding work has been done on the crop, aimed particularly at increasing yield, oil content as well as improving disease resistance (Oyolu, 1977; Asoegwu, 1987; Joda *et al*, 1996), a lot more is yet to be done to increase its productivity. Progress is particularly hampered by the dearth of knowledge in basic inheritance patterns of this crop (Susan and Anne, 1988).

This work was therefore designed to give an insight into the inheritance pattern of seed colour and pattern of stripes on fruits in *C. citrullus.* Such information would be useful in future breeding programme involving the crop.

MATERIALS AND METHODS

Three varieties of *C. citrullus* L. viz "barablackedge" (BB), "barawhiteedge" (BW) and "Sewere" (S) were used in this study. The first two were obtained from National Horticultural Research institute (NIHORT) Ibadan while the 3rd one was obtained from NIHORT sub-station at Okigwe.

To confirm that they were homozygous, an evaluation was carried out in which each variety was planted in 25 plastic pots and maintained to maturity at the botanical garden of the University of Calabar. No segregation was observed for the characters under study. Their seeds were then collected and used for hybridization. At flowering, crosses were made in all possible combinations as well as their reciprocals. Since the plant is monoecious, self pollination was prevented by emasculating the female plants before anthesis. Also being an out breeder, unwanted cross pollination was prevented by bagging the emasculated plant a day before the flowers opened. After pollination, the flower was labeled and rebagged for a day before removing the bags. The crossing technique was the same as that described by Bithi and Roy (1971) and Susan and Anne (1988).

The F_1 seeds resulting from the crosses made were planted using a randomized complete block design. These F_1 plants were then selfed to obtain F_2, which were progressed to F3 by the same method. Although it is naturally an outbreeder, it was possible to enforce selfing on these plants by bagging, since they are monoecious and the male and female flowers ripen about the same time. At each planting, fruits were harvested at maturity, broken and heaped in their various groups to ferment. Seeds were extracted when the pulp rotted, washed properly with water, dried and placed in their various groups. Segregation counts were made from F_2 & F_3 progenies for both stripe pattern on fruits and seed colour and subjected to chi-square analyses to determine the goodness of fit for the observed and expected genetic ratios (Bains and Kang, 1963; Hoffman & Nugent, 1973, Nugent and Hoffman, 1974).

RESULTS

A. Pattern of stripe on fruits in F_1 F_2 and F_3 generations.

The F_1 hybrids as well as the F_2 and F_3 segregating behaviour of progenies of various crosses involving pattern of stripe on fruits are presented in Table 1.

In the cross "sewere" (striped epicarp) x "barawhiteedge" (nonstriped) striped was dominant over non-striped as all the F_1 members had stripes. F_2 progenies segregated in a ratio of 3 striped: 1 non-striped. The F_3 progenies from F_2 striped produced a mixture of striped and non-striped in a ratio of 3:1 whereas the F_3 progenies from non-striped F_2 were all non-striped confirming the monogenic inheritance of this trait with non-striped as recessive.

F_1 offspring of the cross between "barablackedge" (striped epicarp) x "barawhiteedge" (non-striped epicarp) all had fruits with stripes. A ratio of 3 striped: 1 non-striped was obtained in the F_2 generation indicating again that striped epicarp is dominant over non-striped.

F_3 progenies raised from F_2 striped fruits produced a mixture of striped and non-striped fruits while the F_3 progenies from F_2 non-striped were all non-striped confirming again the monogenic inheritance of this trait (Table 1).

B. Seed colour in F_1 F_2 & F_3 progenies

(i) F_1 progenies.

Results obtained on seed colour in all the crosses

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Table 1: F_1 hybrids, F_2 and F_3 segregation pattern of hybrid progenies from crosses involving pattern of stripe on fruits in *C. citrullus* varieties studied.

Generations	Striped	Unstriped	Total	Ratio	X^2	P
1						
Parents						
Sewere (S)	24		24			
(Striped)				-	-	-
X						
Barawhite edge (BW)		24	24			
(non unstriped)		-				
F_1	48	-	48			
F_2	31	13	44	3:1	0.4848	0.30-050
F_3 (from F_2 striped)	28	7	35	3:1	0.467	0.30-0.50
F_3 (from F_2 non-striped)	-	12	12	-	-	-
2						
Barablack edge (BB)	24		24			
(Striped)						
X						
Barawhite edge (BW)		24	24	-	-	-
(unstriped)						
F_1	48	-	48			
F_2	28	12	40	3:1	0.5333	0.30-0.50
F_3 (from F_2 striped)	20	9	29	3:1	0.563	0.30-0.50
F_3 (from F_2 non-striped)	-	10	10	-	-	-

Table 2: F_1 behaviour of hybrid progenies involving seed colour in *C citrullus* varieties studied.

S/n Crosses	F_1 hybrids.
1. S (sewere) x BW (barawhite edge)	S (yellow seeds)- Sewere
2. BW x S	BW(yellow seeds with white edges
3. S x BB(barablack edge)	S (yellow seeds)
4. BB X S	BB(yellow seeds with black edges).
5. BB X BW	BB(yellow seeds with black edges)
6. BW X BB	BW(yellow seeds with whiteedges).

made showed clearly that the F_1 progenies maintained the characteristic features of their maternal parents. Seeds from the cross S x BW were yellow (resembling the maternal parent "sewere" (s) while those of BW x S had white edges (a characteristic feature of "barawhite edge" (BW).

The cross S X BB produced type S (sewere) seeds while it's reciprocal BB X S produced seeds with black edge (BB= "barablack edge").

Seeds obtained from the cross BB X Bw had black edges (BB) while those from BW X BB produced seeds with white edges (BW) see Table 2.

(ii) F_2 Progenies.

The F_2 segregation for seed characteristics is presented in Table3. F_2 segregating generation of the cross S x BB and its reciprocal produced S and BB progenies respectively. 1n S x BB cross, a ratio of 9S:7BB was noted in F_2 while BB X S cross produced 9BB :7S ratio in F_2 generation. In cross BB X BW, F_2 progenies segregated in a ratio of 9BB: 7Bw. Its reciprocal (BBW X BB) produced 9BW : 7BB ratio. The cross between S X BW segregated into 9S : 7Bw in the F_2 where as its reciprocal (BW X S) produced a ratio of 9BW : 7S.

Chi- square analysis of the data showed a good fit at 9:7 between Observed and expected ratios in all the populations.

(iii) F_3 generation (see Table 4).

Various ratios were obtained in F_3 generation of crosses involving seed colour as displayed in Table 4. The ratios were slight modifications of what were obtained in F_2.

DISCUSSION

Pattern of stripes on fruits.

The results presented in Table 1 show that striped epicarp is dominant to non – striped and may be controlled by a single gene pair. This result is in line with that of Eyberg *et al* (1980) who reported that striped epicarp is dominant over non-striped and is controlled by a single dominant gene. Ganesan (1992) also had a similar result when he reported that striped fruit colour in muskmelon is controlled by a single gene pair. However, the result differs from what was reported by Pitrat (1994) who suggested that striped epicarp in *Cucumis melo* is recessive to non-striped. These differences may be a reflection of the uncertainty still surrounding the nomenclature of this

Table 3 F_2 segregation of hybrid progenies in various crosses involving seed colour in C. citrullus varieties studied.

S/N	Crosses	F_2 phenotypes	Total population Observed	Expected	Ratio	X^2 value	p (range)
1.	S X BW	Sewere (S)	689	707	9:7	1.0484	0.30-0.50
		Barawhite edge(BW)	567	549			
2.	BW X S	Barawhite edge(BW)	675	692	9:7	0.9548	0.30-0.50
		Sewere (S)	555	538			
3.	S X BB	Sewere (S)	665	698	9:7	3.5657	0.30-0.50
		Barablack edge (BB)	576	543			
4.	BB X S	Barablack edge (BB)	645	661	9:7	0.8854	0.30-0.50
		Sewere (S)	530	514			
5.	BB X BW	Barablack edge (BB)	631	645	9:7	0.6943	0.30-0.50
		Barawhite edge (BW)	516	502			
6.	BW X BB	Barawhite edge (BW)	719	734	9:7	0.7940	0.30-0.50
		Barablack edge	586	571			

Table 4. Breeding behaviour of F_3 progenies involving seed colour in *C. citrullus* varieties studied.

S/N	Crosses	F_2	F_3	Total population Observed	Expected	Ratio	X^2 value	P (range)
1.	SXBW	Sewere	Sewere	189	197			
			Barawhitedge.	162	154	9:7	0.7404	0.30-0.50
2.	BWXS	barawhitedge	Barawhitedge	233	239			
			sewere	61	55	13:3	0.8051	0.30-0.50
		Barawhitedge	Barawhitedge	177	183	9:7	0.4502	0.50-0.70
			Sewere	148	142			
		sewere	Sewere	355	362	15:1	2.1773	0.05-0.10
			Barawhitedge	31	24			
3.	SXBB	Sewere	Sewere	229	237	10:6	0.7202	0.30-0.50
			Barablackedge	150	142			
		Barablackedge	Barablackedge	180	176	13:3	0.4811	0.30-0.50
			Sewere	37	41			
4.	BBXS	Barablackedge	Barablackedge	199	192	9:7	0.5288	0.30-0.50
			Sewere	140	149			
		sewere	Sewere	218	222	11:5	0.2305	0.50-0.70
			barablackedge	105	101			
5.	BBXBW	Barablackedge	Barablackedge	218	211	10:6	0.6211	0.30-0.50
			Barawhitedge	119	126			
		barawhitedge	barawhitedge	213	219	12:4	0.6576	0.30-0.50
			barablackedge	79	73			
6.	BWXBB	Barawhitedge	Barawhitedge	280	289	11:5	0.9597	0.30-0.50
			Barablackedge	140	131			
		barablackedge	Barablackedge	223	219			
			barawhitedge	27	31	14:2	0.5892	0.30-0.50

species or they may be due to the influence of the environment. From the present findings however, it is almost certain that inheritance of striped pattern in melon is monogenic.

Seed colour.
In the F_1 the progenies maintained the characteristic features of their maternal parents, which would naturally suggest the influence of maternal effect. However, results from F_2 and confirmed by F_3 studies indicate that seed colour is actually controlled by two genes in these plants (dihybrid inheritance). The slight modification from 9:3:3:1 ratio noticed here may be due to epistatic effect between the genes, the effect being more pronounced in F_3 generation than in F_2 as reflected in the ratios. These results are similar to earlier reports made by Gevesan (1988) on muskmelon.

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