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DEVELOPMENT OF BREEDING LINES FROM THE HOT PEPPER CULTIVAR, WEST INDIES RED

Herman V. Adams *and Derek D. Sisnett, Caribbean Agricultural Research and Development Institute, Graeme Hall, Christ Church, Barbados*

ABSTRACT: The hot pepper cultivar, "West Indies Red," was described. Three breeding lines were extracted from this popular cultivar in order to develop lines with more uniform berry shape, size and colour. These lines were compared to the parental population and described showing differences only in berry quality upon which selection pressure was applied. The next round of the Single Seed Descent selection procedure will be applied to ensure further homozygosity for berry colour, shape and size.

INTRODUCTION

The hot pepper cultivar, "West Indies Red" (*Capsicum chinense* Jacquin) was selected by CARDI-Antigua (Cooper1989) who distributed quality seed to producers in several Caribbean countries and also exported to Africa. Both the domestic and foreign markets prefer the berry quality that is reminiscent of the cv. Scotch Bonnet for which premium prices are paid. The West Indies Red displays comparatively the highest level of general adaptability to the agro-ecological conditions of the Caribbean where it is found to be tolerant to viral diseases (Geminiviruses, TEV and PVY) and insect pests.

However, the exporters of fresh berries, in particular, find that the berries of the West Indies Red are too heterogeneous in shape, size and colour. The task, therefore, is to improve this cultivar by making the berries more uniform in these characters.

MATERIALS AND METHODS

In 1996, breeder's seed of the selection, West Indies Red, was obtained from CARDI-Antigua. An observation plot of 7,000 individuals was planted on one half hectare in Barbados. The Capsicum Descriptors (IPGRI et al 1995) were applied to describe the cultivar. About 10% of the plants in the plot was sampled at random and described.

In 1997, an isolated plot of one hectare was planted and simple recurrent mass selection was applied for berry shape, colour and size just before full maturity. Three different lines based on these three characters selected.

In 1998, the three different lines were planted into three separate plots and selection was continued for the same three characters.

In 1999, the lines were again planted and the most robust, prolific and typical plants were selected. Single flower isolations were made to ensure selfing and berries were harvested singly. This was in preparation for the next round of the Single Seed Descent (SSD) selection procedure (Allard 1960).

Simultaneously with the above, a comparative trial was carried out on the three lines and their parent population. The design used was a randomized 4x4 Latin square replicated twice. The treatments were therefore replicated eight times. All field operations were evenly applied over the experimental plots. The last harvest was completed on 15 September 1999. The data were subjected to the analysis of variance using the MINITAB statistical software (MINITAB 1996).

RESULTS AND DISCUSSION

The cultivar, West Indies Red, was described. The Capsicum Descriptors are presented in Table 1. This cultivar in Barbados exhibited very high levels of general adaptability, tolerance to pest and diseases, possessed high pungency and unique organoleptic qualities. The mean dimensions of the berries

were 3.8 cm long x 3.21 cm wide and 84 - 100 berries weighed a kilogram. There was a mixture of shapes of berries; about 10 - 15% had the equatorial fold of the Scotch Bonnet, and the rest were elongate, lantern shaped, some were blocky while others were oblong. There were many colours and hues on the berries at full development just before full maturity. Some were very pale green to cream, very dark green, some with a purple blush or splash on the shoulders and others light green. This wide variability in berry shapes and colours lent itself to the extraction of breeding lines based on these characters. Three lines were differentiated and named 'Caribbean Green,' 'Caribbean Red' and 'Caribbean Purple.' Some of the more important Capsicum Descriptors of the three lines, are presented in Table 2. The main visual difference between the lines was in the colour of the berries just before full maturity. They were as follows: 'Caribbean Red' – cream; 'Caribbean Purple' - purple splash on light green; 'Caribbean green' - deep, dark green.

The berries of all the lines turned red upon full maturity. The berries within each breeding line were of more uniform shape, size and colours than the parent population, 'West Indies Red.' The three breeding lines did not differ significantly from 'West Indies Red' in the characters of total number of berries per plant, mean plant height, mean canopy width and mean berry weight. Significant differences were observed in mean length and mean width of berries (Table 3). The longest berry (4.07 cm) was borne by the 'Caribbean Purple' and the shortest (3.77 cm) by the 'Caribbean Red.' The blockiest berry where the width was almost the same as the length was observed on the 'Caribbean Red': the mean berry length was 3.77 cm and the mean width was 3.14 cm. The 'Caribbean Purple' and cv. West Indies Red were equal in berry width which was significantly narrower than that of the 'Caribbean Red' and the 'Caribbean Green.'

It was very important to confirm that the three breeding lines were the same as the 'West Indies Red' in plant ideotypic and yield characters. This meant that selection gains were made in the desired directions of berry colour, shape and size.

Work will continue along the SSD procedure in order to fix berry colour, size and shape in the breeding lines until maximum homozygosity, hence uniformity, is reached. Selection between and within progeny rows from selected berry types should lead to the desired uniformity and stability by the S_4-S_6 generations. An effort will be made to accelerate cultivar development by producing 2-3 generations per year.

CONCLUSIONS

The extraction of three breeding lines from the hot pepper cultivar, West Indies Red, progressed up to the point of single fruit selection after three cycles of simple recurrent mass selection. The lines differed from the parental population only in the desired characters of berry colour, size and shape. The next step is SSD to attain the highest level of homozygosity and uniformity in berry colour and shape.

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Table 1. A description of the cultivar West Indies Red (*Capsicum chinense* Jacq.) according to some main descriptors.

Plant descriptor	**State**
Stem colour	Biennial
Nodal anthocyanin	Green
Stem shape	Green
Stem pubescence	Cylindrical
Plant height	Sparse
Plant growth habit	66-100 cm
Plant canopy width	Intermediate between prostate and erect
Branching habit	85 cm
Leaf colour	Dense
Leaf shape	Green
Lamina margin	Ovate to lanceolate
Leaf pubescence	Entire
	Sparse
Infloresence descriptor	**State**
Days to flowering	65 days
Number of flowers per axil	Range 1-5; mode 2; mean 2-3
Flower position	Intermediate between pendant and erect
Corolla colour	Greenish white
Corolla spot colour	None
Corolla shape	Rotate
Corolla length (mm)	1-5
Another colour	Bluish
Another length (mm)	1-1.2
Filament colour	White
Filament length (mm)	1
Stigma exsertion	Slightly exserted
Infloresence descriptor	**State**
Male sterility	Absent
Calyx pigmentation	Absent
Calyx margin	Intermediate
Calyx annular constriction	Present
Fruit descriptor	**State**
Fruit colour at intermediate stage	Light green; dark green, purple blush and cream
Fruit set	High
Fruit bearing (number of days from first fruit set to last fruit formation)	240-360
Fruit colour at mature stage	Red and dark red
Fruit shape	A mix of campanulate and blocky shapes with a small percentage carrying the equatorial fold of the Scotch Bonnet parent
Fruit length (cm)	3.8
Fruit width (cm)	3.21
Fruit weight (g)	10.80
Fruit pedicel length (cm)	1.9
Fruit wall thickness (mm)	1.5-2.5
Fruit shape at pedicel attachment	Truncate, cordate and lobate
Neck at base of fruit	Absent
Fruit shape at blossom end	Blunt, sunken, sunken and pointed types
Fruits cross-sectional corrugation	Intermediate
Plant descriptor	**State**
Number of locules	3-4
Fruit shape	A mix of campanulate and blocky shapes with a small percentage carrying the equatorial fold of the Scotch Bonnet parent
Fruit surface	Smooth
Ripe fruit persistence	
Pedicel with stem	Intermediate
Pedicel with fruit	Intermediate
Placenta length	¼-½ fruit length
Seed description	**State**
Seed colour	Straw
Seed surface	Smooth
Seed size	Intermediate
Seed diameter (mm)	3
1000 seed weight (g)	4.5
Number of seeds per fruit	20-50

Table 2. Description of the 3 breeding lines extracted from cv West Indies Red in 1999 at Graeme Hall, Barbados.

Descriptors	Caribbean Green	Caribbean Red	Caribbean Purple
Shape of berry	Blocky	Cylindrical	Blocky
Length of berry (cm)	3.76	4.2	4.6
Width of berry (cm)	3.32	2.8	3.9
Weight of berry (g)	12	13	8.8
Berries/kg	85	89	100
Berries/lb	38	40	45
Colour of unripe berries	Deep dark green	Pale light green	Green with a purple blush
Colour of ripe berries	Deep dark red	Light red	Dark red
Berries/node	2	2	2
Berries/plant/picking	32	33	33
Fruit stalk length (cm)	2.7	2.2	2.8
Stalk persistence on plant	Intermediate	Intermediate	Intermediate
Stalk persistence on berry	Persistent	Persistent	Persistent
Fruit wall thickness (mm)	2.6	1.2	2
Locules/berry	4	4	4
Exocarp smoothness	Very smooth	Smooth	Smooth
Corrugation of berry	Corrugated	Corrugated	Corrugated
Calyx margin	Intermediate	Intermediate	Intermediate
Calyx annular ring	Present	Present	Present
Plant height (cm)	80.66	79.52	77.27
Plant width (cm)	97.6	97.38	95.27
Leaf shape	Ovate	Ovate	Ovate
Leaf length (cm)	9.55	11.60	10.10
Leaf width (cm)	4.1	4.9	4.1
Leaf pubescence (abaxial)	Sparse	Sparse	Sparse
Leaf pubescence (adaxial)	Sparse	Sparse	Sparse
Leaf pubescence pattern	Uniform	Uniform	Uniform
Leaf pigmentation	Green	Green	Green
Stem shape	Cylindrical	Cylindrical	Cylindrical
Stem pigmentation	Green	Light Green	Green
Stem pubescence pattern	Sparse	Sparse	Sparse
Stem pubescence pattern	Sparse	Sparse	Sparse
Nodal pigmentation	Green	Green	Green
Growth habit	Intermediate	Intermediate	Intermediate
Days to emergence	Seven	Seven	Seven
Days to transplanting	Thirty-five	Thirty-five	Thirty-five
Plants/ha/ac (000)	30-40/12-16	30-40/12-17	30-40/12-18
Days to flowering	39	39	39
Days to harvest	80	80	80
Harvest duration (months)	>6	>6	>6

Table 3. A comparison between West Indies Red and three breeding lines in a varietal test grown in 1999 in Barbados

Treatment	Total No. fruits/plant	Mean height of plant (cm)	Mean width of plant (cm)	Mean weight of fruit (g)	Mean length of fruit (cm)	Mean width of fruit (cm)
Caribbean Purple	227.40	77.27	95.27	10.4	4.07	3.05
West Indies	236.20	76.68	96.79	10.26	3.91	3.05
Caribbean Red	228.90	79.51	97.38	10.59	3.77	3.14
Caribbean Green	222.67	80.24	97.58	12.36	3.97	3.12
SEM (df=18)	11.09	1.46	1.42	0.69	0.06	0.04
P	0.857NS	0.280NS	0.662 NS	0.146 NS	0.018**	0.293NS

NS = not significant, ** = significant