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INHERITANCE OF CLUSTERNESS AND FRUIT ORIENTATION IN CHILLI (*CAPSICUM ANNUUM* L.)

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ABSTRACT

In a hybridization programme involving four chilli lines, Jwala, Pant C-1, CA 33 and CA 23, their F_1, F_2, BC_1 and BC_2 generations were evaluated to study the inheritance of clusterness, and fruit orientation. Clusterness was found to be monogenic recessive to solitary fruiting habit. The genotype of the clustered accession CA 33 is proposed as cl_1cl_1. The upright fruit orientation is controlled by two recessive genes in relation to pendulous condition. Genes up_1 and up_2 operate with specific dominant and recessive epistasis for the control of upright fruit orientation.

Key words: Chilli, inheritance, clusterness, fruit orientation.

Information on the genetics of desirable characters is important in the improvement of chilli. Such information from inheritance studies enables the breeder to manipulate the genes on a more scientific basis. Indeterminate growth habit, solitary bearing habit, and nonuniform ripening are a few undesirable traits in chilli preventing mechanical harvesting. Indeterminate growth pattern in the commercial varieties results in production of a single flower at each branching node, which is harvested individually. This amounts to nearly 20% of the total cost of cultivation for harvesting of solitary fruits alone. Transfer of clusterness or multiple flower character to cultivated varieties would result in more concentrated fruit set, uniform maturity, and reduced cost of harvesting. In the present study an attempt has been made to transfer the property of clusterness to commercial varieties and understand the inheritance of clusterness and fruit orientation in chilli.

MATERIALS AND METHODS

The F_1, F_2, BC_1 and BC_2 generations of crosses involving four parents, i.e. Jwala, Pant C-1, CA 33 and CA 23, were grown during May-September 1983 at College of Horticulture, Vellanikkara. Varieties Jwala and Pant C-1 are solitary fruited varieties, while CA 33 and CA 23 are cluster bearing. Jwala and CA 23 had pendulous fruits. In Pant C-1 and CA 33 fruits are erect. Crosses Jwala × CA 33, Pant C-1 × CA 33 and Jwala × CA 23 were made to study the inheritance of clusterness. Crosses Jwala × Pant C-1, Jwala × CA 33 and CA 33 × CA 23 crosses

were used to understand the gene action of fruit orientation. The agreement of the observed values with the expected was tested by χ^2 test.

RESULTS AND DISCUSSION

In indeterminate varieties, Jwala and Pant C-1, the main stem continued to grow to a particular height, terminated in a solitary flower and bifurcated. Each branch terminated in a flower after a few nodes and again bifurcated and this type of branching continued. In CA 33 and CA 23, the main stem terminated in a cluster of flowers after growing to the height of about 30 cm. This was followed by formation of a few primary branches acropetally from the main stem which, in turn, resulted in a number of clusters.

All the 47 F_1 plants of the cross Jwala × CA 33, 37 plants in Pant C-1 × CA 33, and 26 plants in Jwala × CA 23 were solitary, indicating dominance of solitary over clustered habit (Table 1).

In the cross Jwala × CA 33, 321 F_2 plants segregated into 244 solitary and 77 clustered, which fits 3 : 1 ratio. In the BC_1 generation, 232 out of 235 plants were solitary and the remaining clustered, which fits the expected ratio of 1 : 0. In the BC_2 generation, 150 out of 271 plants were solitary and the remaining 121 were clusterd, fitting in the 1 : 1 ratio and thus confirming monogenic recessive

Table 1. Inheritance of clusterness in chilli

Cross generation	Observed number of plants			Expected genetic ratio	χ^2	P
	solitary	clustered	total			
Jwala × CA 33						
P_1	38	0	38			
P_2	0	46	46			
F_1	47	0	47			
F_2	244	77	321	3 : 1	0.18	0.50–0.70
BC_1	232	3	235	1 : 0	1.76*	0.05–0.10
BC_2	150	121	271	1 : 1	3.10	0.05–0.10
Pant C–1 × CA 33						
P_1	42	0	42			
P_2	0	46	46			
F_1	37	0	37			
F_2	188	59	247	3 : 1	0.11	0.70–0.80
BC_1	291	0	291	1 : 0	0.00*	1.00
BC_2	162	169	231	1 : 1	0.73	0.30–0.50
Jwala × CA 23						
P_1	38	0	38			
P_2	0	26	26			
F_1	26	0	26			
F_2	225	51	276	13 : 3	0.01	0.90–0.95
BC_1	232	5	237	1 : 0	2.25*	0.02–0.05
BC_2	147	78	225	1 : 1	21.16	Below 0.001

*t value significant at 5% level.

inheritance of clusterness. The observed ratios in F_2, BC_1 and BC_2 of the cross Pant C-1 × CA 33 also confirmed monogenic recessive nature of cluster bearing habit.

The present monogenic and recessive inheritance of clusterness in chilli is in agreement with the earlier reports [1, 2]. The genotypes of the above three parents are proposed:

Jwala	CL_1 CL_1
Pant C–1	CL_1 CL_1
CA 33	cl_1 cl_1

In the crosses involving CA 23 also, dominance of solitary over clustered habit observed, however, with deviation from monogenic inheritance. The 276 F_2 plants in the BC_1 and BC_2 generations failed to confirm digenic inheritance. This necessitates further study to determine the genotype of CA 23.

In this study not a single plant with indeterminate growth habit had cluster fruiting. This showed that determinate growth habit is a pleiotropic manifestation of clustered fruiting trait.

Table 2. Inheritance of fruit orientation in chilli

Cross generation	Observed number of plants			Expected genetic ratio	χ^2	P
	pendulous	upright	total			
Jwala × Pant C–1						
P_1	38	0	38			
P_2	0	42	42			
F_1	42	0	42			
F_2	286	74	360	13 : 3	0.77	0.30–0.50
BC_1	260	2	262	1 : 0	0.99*	0.20–0.40
BC_2	84	108	192	1 : 1	3.00	0.05–0.10
Jwala × CA 33						
P_1	38	0	38			
P_2	0	46	46			
F_1	47	0	47			
F_2	254	67	321	13 : 3	0.95	0.30–0.50
BC_1	232	3	235	1 : 0	1.76*	0.05–0.10
BC_2	151	120	271	1 : 1	3.55	0.05–0.10
CA 33 × CA 23						
P_1	0	46	46			
P_2	26	0	26			
F_1	35	0	35			
F_2	264	70	334	13 : 3	1.07	0.30–0.50
BC_1	112	89	201	1 : 1	2.24	0.02–0.05
BC_2	269	5	274	1 : 0	2.64*	0.01–0.001

*t value significant at 5% level.

All the 42 plants in the cross Jwala × Pant C–1, 47 plants in Jwala × CA 33, and 35 plants in CA 33 × CA 23 had pendulous fruits, indicating dominance of pendulous trait over erect fruit orientation (Table 2). This is in agreement with earlier findings [3, 4]. In the F_2 generation of cross Jwala × Pant C–1, 360 plants segregated in to 286 pendulous and 74 erect fruited plants, fitting the 13 : 3 segregation ratio. In BC_1, there was only a rare occurence of 2 upright fruited plants out of 262. This observed frequency fits the expected 1 : 0 ratio. The 192 BC_2 plants segregated in 1 : 1 ratio, suggesting digenic inheritance.

The F_2, BC_1 and BC_2 generations of the crosses Jwala × CA 33 and CA 33 × CA 23 also confirm digenic inheritance with specific dominant and recessive epistasis, in which gene up_1 is epistatic over up_2. The proposed genotypes of the four parents for fruit orientation are as follows:

Jwala	up_1^+ up_1^+ up_2 up_2
CA 23	up_1^+ up_1^+ up_2 up_2
Pant C–1	up_1 up_1 up_2^+ up_2^+
CA 33	up_1 up_1 up_2^+ up_2^+

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