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INHERITANCE PATTERNS ASSESSMENT OF MORPHOLOGICAL AND FRUIT TRAITS THROUGH GENERATION MEAN ANALYSIS IN TOMATO (*SOLANUM LYCOPERSICUM* L.)

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ABSTRACT

A field study titled "Generation Mean Analysis Studies in Tomato (*Solanum lycopersicum* L.)" was conducted at the Post Graduate Institute for Horticultural Sciences, Sri Konda Laxman Telngana Horticultural University (SKLTGHU), Mulugu, Siddipet District, Telangana, over two seasons. The experiment was conducted using five crosses involving seven diverse parental lines: EC632944, EC631378, EC631477, EC631455, Pusa Ruby, MHT0100 and MHT0101. Six generations (P_1, P_2, F_1, F_2, BC_1F_1 and BC_2F_1) of each cross were developed and evaluated to assess inheritance patterns of morphological and fruit traits. The experiment was arranged in a Randomized Block Design (RBD) with three replications, with plants grown in a compact family layout. Growth habit, foliage density, leaf type displayed a considerable variations in segregating generations and inflorescence type remained stable as uniparous even when multiparous parents were involved. Fruit traits exhibited more variability, with no green shoulder on stripes across generations, but distinct segregation in shape and size. Fruit size homogeneity was mostly intermediate, though some plants exhibited higher uniformity, while slightly depressed shoulders and round cross-sectional shapes remained consistent with occasional irregularities. Variability was noted in pistil scar and blossom-end shapes. Overall, the study demonstrated that growth type, leaf type and inflorescence type were largely stable, while fruit size, shape and related traits segregated more prominently, reflecting the role of both additive and non-additive gene actions.

Key words : Tomato, Generation mean analysis, Inheritance, Additive gene action, Non-additive gene action.

Introduction

Tomato is one of the most economically significant vegetable crops, providing vital income support for numerous low-income farmers (Geofrey *et al.*, 2025). Its wide adaptability, high productivity and diverse use in both fresh consumption and processing industries have made it a popular crop across tropical, subtropical and temperate regions (Damor *et al.*, 2021). Tomato (*Solanum lycopersicum* L.), a key fruit vegetable from the Solanaceae family, is widely cultivated for its adaptability, high yield and consumer popularity in both ripe and unripe forms (Ali *et al.*, 2023). This diploid plant (2n = 2x = 24) is mainly self-pollinating but can experience some cross-pollination (Sharma, 2022). Globally, tomatoes are second only to potatoes in area and production, yet they lead as the most processed vegetable, highlighting their importance in the food industry (Vats *et al.*, 2022). Tomatoes are also highly valued for both their economic importance and their nutritional benefits, positioning them as a key crop among other solanaceous vegetables (Ouattara *et al.*, 2024). The cherry tomato (*Lycopersicon esculentum* var. *cerasiformae*) is

considered the ancestor of modern cultivated tomato (Nayyer *et al*., 2021; Kaushal and Sadashiva, 2025; Rick, 1983). Tomato is a nutrient-rich food, providing ample potassium, folate, vitamin E and both soluble and insoluble dietary fibers (Kumar *et al*., 2022). The evaluation of phenotypic traits such as fruit morphology, color intensity, nutritional quality, firmness, flavor and aroma are challenging and time-consuming because of the quantitative nature of the traits (Fiorani and Schurr, 2013). However, study on phenotypic attributes is needed, because those parameters have been widely used for the assessment of genetic diversity, breeding value and yield potential of the crop (Salim *et al*., 2020).

Materials and Methods

A field investigation was carried out at the Post Graduate Institute for Horticultural Sciences, SKLTGHU, Mulugu, Siddipet District, Telangana in two seasons. The first experiment conducted to develop six generations (P_1, P_2, F_1, F_2, BC_1F_1 and BC_2F_1) by using seven parents (EC632944, EC631378, EC631477, EC631455, Pusa Ruby, MHTO100 and MHTO101) and five promising hybrids which were developed and evaluated in preceeding work. Another experiment was conducted for evaluation of six generations during *spring Summer*, 2025 in Randomized Block Design with three replications by planting in compact family manner. The related traits *viz*., Growth type, Foliage Density, Leaf type, Inflorescence type, Presence of green (shoulder) strips on the fruit, Predominant fruit shape, Fruit size, Fruit size homogeneity, Fruit shoulder shape, Fruit cross sectional shape, Shape of pistil scar, Fruit blossom end shape were assed as per "Descriptors for Tomato (*Lycopersicon* spp.)" by International Plant Genetic Resources Institute, Biodiversity International for all the six generations.

Results and Discussion

Growth type

In the cross EC632944 × MHT0101, parent EC632944 was indeterminate and MHT0101 semi-determinate, with the F_1 generation being indeterminate. The backcross and F_2 generations showed predominantly indeterminate plants with only a few semi-determinate segregants. In EC631378 × Pusa Ruby, both parents and the F_1 were indeterminate and subsequent generations also remained mostly indeterminate with occasional semi-determinate plants. In EC631378 × MHT0101, EC631378 was indeterminate and MHT0101 semi-determinate, with the F_1 being indeterminate. The backcross and F_2 generations displayed a majority of indeterminate plants along with a small proportion of semi-determinate segregants. In EC631477 × Pusa Ruby, both parents and F_1 were indeterminate and later generations continued to be largely indeterminate with very few semi-determinate types. In EC631455 × MHT0100, the parent EC631455 was indeterminate and MHT0100 semi-determinate. However, the F_1 and all subsequent generations were completely indeterminate without any segregation.

Foliage density

Plant density varied across crosses and generations. In the cross EC632944 × MHT0101, both parents and

Table 1 : The generations for which morphological and fruit related traits were recorded.

S. no.	Generation	Cross number				
		I	II	III	IV	V
1.	P_1	EC632944	EC631378	EC631378	EC631477	EC631455
2.	P_2	MHTO 101	Pusa Ruby	MHTO 101	Pusa Ruby	MHTO 100
3.	F_1	EC632944 × MHTO 100	EC631378 × Pusa Ruby	EC631378 × MHTO 101	EC631477 × Pusa Ruby	EC631455 × MHTO 100
4.	F_2	EC632944 × MHTO 101	EC631378 × Pusa Ruby	EC631378 × MHTO 101	EC631477 × Pusa Ruby	EC631455 × MHTO 100
5.	BC_1F_1	(EC632944 × MHTO 101) × EC632944	(EC631378 × Pusa Ruby) × EC631378	(EC631378 × MHTO 101) × EC631378	(EC631477 × Pusa Ruby) × EC631477	(EC631455 × MHTO 100) × EC631455
6	BC_2F_1	(EC632944 × MHTO 101) × MHTO 101	(EC631378 × Pusa Ruby) × Pusa Ruby	(EC631378 × MHTO 101) × MHTO 101	(EC631477 × Pusa Ruby) × Pusa Ruby	(EC631455 × MHTO 100) × MHTO 100

P_1: Female parent; P_2: Male parent; F_1: First generation after cross pollination; F_2: Second generation after cross pollination; BC_1F_1: Back population after crossing of first generation with Female parent; BC_2F_1: Back population after crossing of first generation with male parent.

the F_1 generation exhibited intermediate density, while the backcross and F_2 generations segregated into sparse, intermediate and dense plants, with intermediate density being most common. In the cross EC631378 × Pusa Ruby, one parent was sparse and the other intermediate, with the F_1 generation showing intermediate density; subsequent backcross and F_2 generations included mostly intermediate plants, alongside some sparse and a few dense ones. For the cross EC631378 × MHT0101, with one sparse and one intermediate parent, the F_1 was sparse and the backcross and F_2 generations displayed a mix of sparse, intermediate and dense plants, with intermediate and sparse densities prevailing. In the cross EC631477 × Pusa Ruby, both parents and the F_1 were intermediate and later generations showed predominantly intermediate density, with some sparse and fewer dense plants. Finally, in the cross EC631455 × MHT0100, both parents and the F_1 were intermediate, with backcross and F_2 generations consisting mostly of intermediate and sparse plants and a small proportion of dense ones.

Leaf type

In the cross EC632944 × MHT0101, both parents and the F_1 generation were standard/Peruvianum, with all subsequent generations remaining standard. In the cross EC631378 × Pusa Ruby, one parent was standard and the other dwarf, resulting in a dwarf F_1; backcross and F_2 generations showed a mix of dwarf and standard plants, with standard types more prevalent. For the cross EC631378 × MHT0101, with one standard and one Peruvianum parent, the F_1 was standard and backcross and F_2 generations included both Peruvianum and standard plants, with standard types dominating. In the cross EC631477 × Pusa Ruby, a standard and a dwarf parent produced a standard F_1, with backcross and F_2 generations containing mostly standard plants and a small proportion of dwarf ones. Finally, in the cross EC631455 × MHT0100, both parents and the F_1 were Peruvianum, with backcross and F_2 generations consisting of predominantly standard plants and a smaller number of Peruvianum types.

Inflorescence type

For inflorescence type, Crosses EC632944 × MHT0101, EC631378 × Pusa Ruby, EC631378 × MHT0101 and EC631455 × MHT0100 exhibited uniparous inflorescences in all generations. In Cross EC631477 × Pusa Ruby, despite EC631477 being multiparous and Pusa Ruby uniparous, the F_1 and all subsequent generations were uniparous.

Presence of green (Shoulder) stripes on the fruit

Absent in all crosses and generations.

Predominant fruit shape

Across various tomato breeding crosses, fruit shapes showed distinct patterns. In the cross EC632944 × MHT0101, the F_1 generation produced flattened fruits, with backcross generations exhibiting both flattened and slightly flattened fruits and the F_2 generation predominantly featuring slightly flattened fruits alongside some flattened ones. In the cross EC631378 × Pusa Ruby, the F_1 generation yielded slightly flattened fruits, the first backcross generation produced both rounded and pyriform fruits, the second backcross generation was exclusively rounded and the F_2 generation was mostly rounded with a few pyriform fruits. For the cross EC631378 × MHT0101, the F_1 generation had slightly flattened fruits, the first backcross included both slightly flattened and cylindrical fruits, while the second backcross and F_2 generations were entirely slightly flattened. In the crosses EC631477 × Pusa Ruby and EC631455 × MHT0100, all generations consistently produced rounded fruits.

Fruit size

Fruit size varied across the different crosses and generations. In EC632944 × MHT0101, both parents and F_1 fruits were small, with backcross generations showing a mix of small, very small and intermediate fruits and F_2 predominantly small. For EC631378 × Pusa Ruby, parents and F_1 were intermediate, backcrosses were mostly small with some intermediate fruits and F_2 largely small with a few intermediate and very small fruits. In EC631378 × MHT0101, parents were intermediate, F_1 small, backcrosses mostly small with some intermediate and very small fruits and F_2 predominantly small. EC631477 × Pusa Ruby had intermediate parents and F_1, backcrosses varying from mostly small to a mix of small and intermediate and F_2 mainly small. In EC631455 × MHT0100, small-fruited parents produced an intermediate F_1, backcrosses were mostly small with a few intermediate fruits and F_2 was largely small.

Fruit size homogeneity

In all five crosses-EC632944 × MHT0101, EC631378 × Pusa Ruby, EC631378 × MHT0101, EC631477 × Pusa Ruby and EC631455 × MHT0100-both parents and their F_1 hybrids were uniformly intermediate in homogeneity. In the backcross generations BC_1F_1 and BC_2F_1, most plants expressed intermediate homogeneity, while the remaining showed high homogeneity. Similarly, in the generation, the majority continued to exhibit intermediate homogeneity, accompanied by a smaller proportion displaying high homogeneity, a pattern consistent across all crosses.

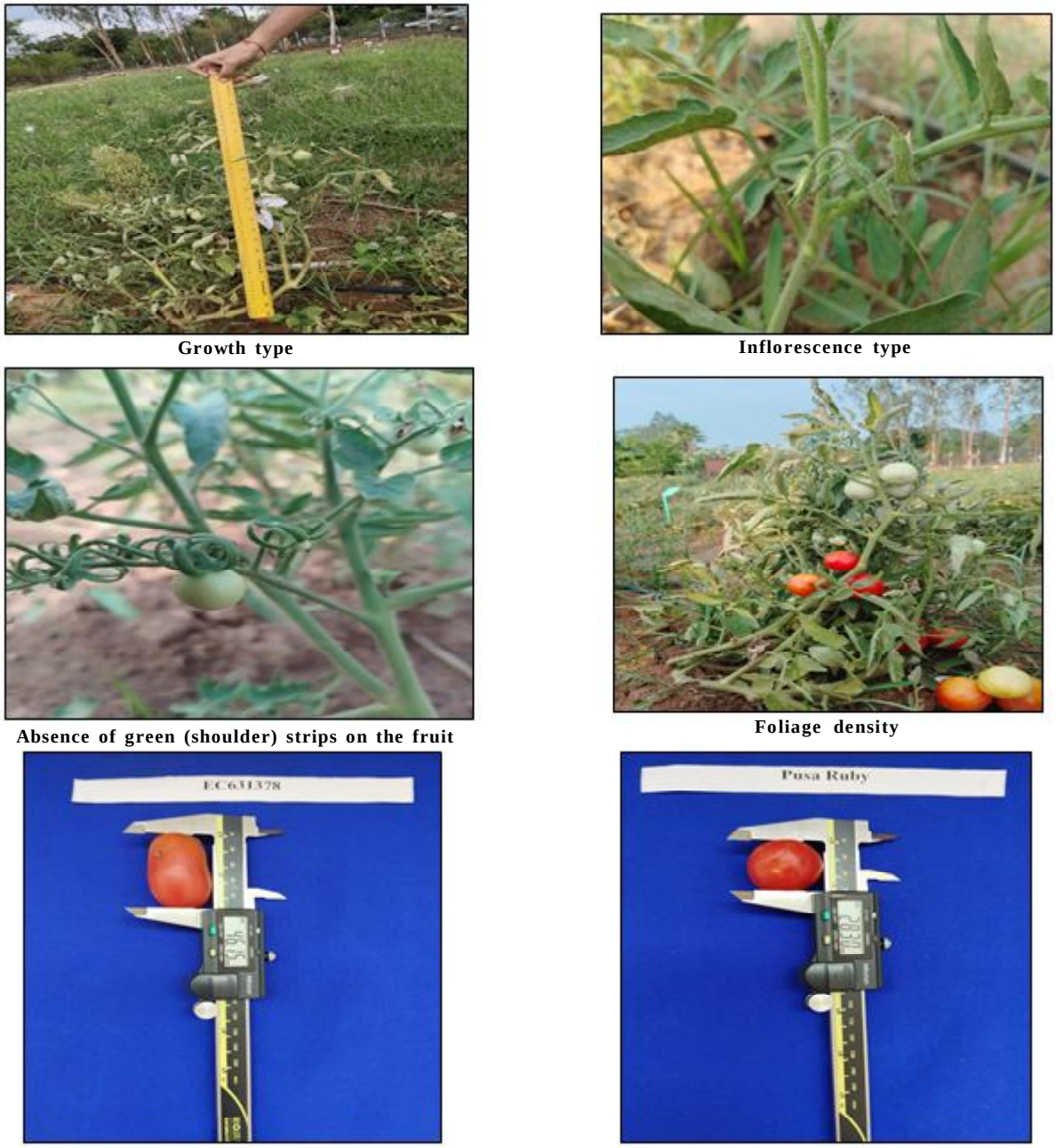

Fig. 1 : Morphological and fruit traits in Tomato (*Solanum lycopersicum* L.).

Fruit shoulder shape

All crosses exhibited slightly depressed shoulders in parents, F_1 and all subsequent generations, with no notable segregation.

Fruit cross sectional shape

All crosses predominantly produced round fruits across parents, F_1, BC_1F_1, BC_2F_1 and F_2, with occasional irregular fruits in some generations.

Shape of pistil scar

Crosses EC632944 × MHT0101 and EC631455 × MHT0100 retained stellate pistil scars in most generations, with minor irregularities. EC631378 × Pusa Ruby and EC631378 × MHT0101 showed dot scars in parents and F_1, with segregation into stellate and linear types in later generations. EC631477 × Pusa Ruby mostly retained dot scars with some irregular types in back cross and F_2 generations.

Fruit blossom end shape

Blossom end shape varied among crosses. In EC632944 × MHT0101, F_1 was flat, segregating into flat and pointed forms in backcross and F_2 generations. EC631378 × Pusa Ruby and EC631378 × MHT0101 also showed segregation between flat, pointed and indented

Table 2 : Morphological and Fruit related traits for five crosses in tomato as per IPGRI.

Parameter	Cross	Generation	Phenotype	Number of plants/Total number of plants observed
Growth type	EC632944 x MHT0101	P_1: EC632944	Indeterminate	30/30
		P_2: MHT0101	Semi-determinate	30/30
		F_1	Indeterminate	30/30
		BC_1F_1	Semi – determinate	3/60
			Indeterminate	57/60
		BC_2F_1	Semi – determinate	4/60
			Indeterminate	56/60
		F_2	Semi – determinate	2/120
			Indeterminate	118/120
	EC631378 x Pusa Ruby	P_1: EC632944	Indeterminate	30/30
		P_2: Pusa Ruby	Indeterminate	30/30
		F_1	Indeterminate	30/30
		BC_1F_1	Semi – determinate	4/60
			Indeterminate	56/60
		BC_2F_1	Semi – determinate	2/60
			Indeterminate	58/60
		F_2	Semi – determinate	4/120
			Indeterminate	116/120
	EC631378 x MHT0101	P_1: EC631378	Indeterminate	30/30
		P_2: MHT0101	Semi-determinate	30/30
		F_1	Indeterminate	30/30
		BC_1F_1	Semi-determinate	4/60
			Indeterminate	56/60
		BC_2F_1	Semi-determinate	3/60
			Indeterminate	57/60
		F_2	Semi-determinate	7/120
			Indeterminate	113/120
	EC631477 x Pusa Ruby	P_1: EC631477	Indeterminate	30/30
		P_2: Pusa Ruby	Indeterminate	30/30
		F_1	Indeterminate	30/30
		BC_1F_1	Semi-determinate	1/60
			Indeterminate	59/60
		BC_2F_1	Semi-determinate	2/60
			Indeterminate	58/60
		F_2	Semi-determinate	5/120
			Indeterminate	15/120
	EC631455 x MHT0100	P_1: EC631455	Indeterminate	30/30

Table 2 continued...

Table 2 continued...

		P_2: MHT0100	Semi-determinate	30/30
		F_1	Indeterminate	30/30
		BC_1F_1	Indeterminate	60/60
		BC_2F_1	Indeterminate	60/60
		F_2	Indeterminate	120/120
Foliage Density	EC632944 x MHT0101	P_1: EC632944	Intermediate	30/30
		P_2: MHT0101	Intermediate	30/30
		F_1	Intermediate	30/30
		BC_1F_1	Sparse	27/60
			Intermediate	26/60
			Dense	7/60
		BC_2F_1	Sparse	24/60
			Intermediate	34/60
			Dense	2/60
Foliage Density		F_2	Sparse	50/120
			Intermediate	58/120
			Dense	12/120
	EC631378 x Pusa Ruby	P_1: EC631378	Sparse	30/30
		P_2: Pusa Ruby	Intermediate	30/30
		F_1	Intermediate	30/30
		BC_1F_1	Sparse	11/60
			Intermediate	41/60
			Dense	8/60
		BC_2F_1	Sparse	8/60
			Intermediate	45/60
			Dense	7/60
		F_2	Sparse	38/120
			Intermediate	76/120
			Dense	6/120
	EC631378 x MHT0101	P_1: EC631378	Sparse	30/30
		P_2: MHT0101	Intermediate	30/30
		F_1	Sparse	30/30
		BC_1F_1	Sparse	25/60
			Intermediate	27/60
			Dense	8/60
		BC_2F_1	Sparse	23/60
			Intermediate	33/60
			Dense	4/60

Table 2 continued...

Table 2 continued...

		F_2	Sparse	52/120
			Intermediate	57/120
			Dense	11/120
	EC631477 x Pusa Ruby	P_1: EC631477	Intermediate	30/30
		P_2: Pusa Ruby	Intermediate	30/30
		F_1	Intermediate	30/30
		BC_1F_1	Sparse	22/60
			Intermediate	33/60
			Dense	5/60
		BC_2F_1	Sparse	22/60
			Intermediate	29/60
			Dense	9/60
		F_2	Sparse	48/120
			Intermediate	63/120
			Dense	9/120
	EC631455 x MHT0100	P_1: EC631455	Intermediate	30/30
		P_2: MHT0100	Intermediate	30/30
		F_1	Intermediate	30/30
		BC_1F_1	Sparse	23/60
			Intermediate	34/60
			Dense	3/60
		BC_2F_1	Sparse	22/60
			Intermediate	34/60
			Dense	4/60
Foliage Density		F_2	Sparse	51/120
			Intermediate	59/120
			Dense	10/120
Leaf type	EC632944 x MHT0101	P_1: EC632944	Standard	30/30
		P_2: MHT0101	Peruvianum	30/30
		F_1	Standard	30/30
		BC_1F_1	Standard	60/60
		BC_2F_1	Standard	60/60
		F_2	Standard	120/120
	EC631378 x Pusa Ruby	P_1: EC631378	Standard	30/30
		P_2: Pusa Ruby	Dwarf	30/30
		F_1	Dwarf	30/30
		BC_1F_1	Dwarf	15/30
			Standard	45/60

Table 2 continued...

Table 2 continued...

		BC_2F_1	Dwarf	41/60
			Standard	19/60
		F_2	Dwarf	88/120
			Standard	32/120
	EC631378 x MHT0101	P_1: EC631378 P_2: MHT0101	Standard Peruvianum	30/30 30/30
		F_1	Standard	30/30
		BC_1F_1	Peruvianum	16/60
			Standard	44/60
		BC_2F_1	Peruvianum	16/60
			Standard	44/60
		F_2	Peruvianum	32/120
			Standard	88/120
	EC631477 x Pusa Ruby	P_1: EC631477	Standard	30/30
		P_2: Pusa Ruby	Dwarf	30/30
		F_1	Standard	30/30
		BC_1F_1	Dwarf	6/60
			Standard	54/60
		BC_2F_1	Dwarf	12/60
			Standard	48/60
		F_2	Dwarf	6/120
			Standard	114/120
	EC631455 x MHT0100	P_1: EC631455	Peruvianum	30/30
		P_2: MHT0100	Peruvianum	30/30
		F_1	Peruvianum	30/30
		BC_1F_1	Peruvianum	10/60
			Standard	50/60
		BC_2F_1	Peruvianum	9/60
			Standard	51/60
		F_2	Peruvianum	20/120
			Standard	100/120
Inflorescence type	EC632944 x MHT0101	P_1: EC632944	Generally uniparous	30/30
		P_2: MHT0101	Generally uniparous	30/30
		F_1	Generally uniparous	60/60
		BC_1F_1	Generally uniparous	60/60
		BC_2F_1	Generally uniparous	60/60
		F_2	Generally uniparous	120/120
	EC631378 x Pusa Ruby	P_1: EC631378	Generally uniparous	30/30
		P_2: Pusa Ruby	Generally uniparous	30/30

Table 2 continued...

Table 2 continued...

		F_1	Generally uniparous	60/60
		BC_1F_1	Generally uniparous	60/60
		BC_2F_1	Generally uniparous	60/60
		F_2	Generally uniparous	120/120
	EC631378 x MHT0101	P_1: EC631378	Generally uniparous	30/30
		P_2: MHT0101	Generally uniparous	30/30
		F_1	Generally uniparous	60/60
		BC_1F_1	Generally uniparous	60/60
		BC_2F_1	Generally uniparous	60/60
		F_2	Generally uniparous	120/120
	EC631477 x Pusa Ruby	P_1: EC631477	Multiparous	30/30
		P_2: Pusa Ruby	Generally uniparous	30/30
		F_1	Generally uniparous	60/60
		BC_1F_1	Generally uniparous	60/60
		BC_2F_1	Generally uniparous	60/60
		F_2	Generally uniparous	120/120
	EC631455 x MHT0100	P_1: EC631455	Generally uniparous	30/30
		P_2: MHT0100	Generally uniparous	30/30
		F_1	Generally uniparous	60/60
		BC_1F_1	Generally uniparous	60/60
		BC_2F_1	Generally uniparous	60/60
		F_2	Generally uniparous	120/120
Presence of green (shoulder) strips on the fruit	EC632944 x MHT0101	P_1: EC632944	Absent	30/30
		P_2: MHT0101	Absent	30/30
		F_1	Absent	30/30
		BC_1F_1	Absent	60/60
		BC_2F_1	Absent	60/60
		F_2	Absent	120/120
	EC631378 x Pusa Ruby	P_1: EC631378	Absent	30/30
		P_2: Pusa Ruby	Absent	30/30
		F_1	Absent	30/30
		BC_1F_1	Absent	60/60
		BC_2F_1	Absent	60/60
		F_2	Absent	120/120
	EC631378 x MHT0101	P_1: EC631378	Absent	30/30
		P_2: MHT0101	Absent	30/30
		F_1	Absent	30/30
		BC_1F_1	Absent	60/60

Table 2 continued...

Table 2 continued...

Presence of green (shoulder) strips on the fruit		BC_2F_1	Absent	60/60
		F_2	Absent	120/120
	EC631477 x Pusa Ruby	P_1: EC631477	Absent	30/30
		P_2: Pusa Ruby	Absent	30/30
		F_1	Absent	30/30
		BC_1F_1	Absent	60/60
		BC_2F_1	Absent	60/60
		F_2	Absent	120/120
	EC631455 x MHT0100	P_1: EC631455	Absent	30/30
		P_2: MHT0100	Absent	30/30
		F_1	Absent	30/30
		BC_1F_1	Absent	60/60
		BC_2F_1	Absent	60/60
		F_2	Absent	120/120
Predominant fruit shape	EC632944 x MHT0101	P_1: EC632944	Flattened	30/30
		P_2: MHT0101	Slightly flattened	30/30
		F_1	Flattened	30/30
		BC_1F_1	Flattened	40/60
			Slightly flattened	20/60
		BC_2F_1	Flattened	39/60
			Slightly flattened	21/60
		F_2	Flattened	49/120
			Slightly flattened	71/120
	EC631378 x Pusa Ruby	P_1: EC631378	Pyriform	30/30
		P_2: Pusa Ruby	Rounded	30/30
		F_1	Slightly flattened	30/30
		BC_1F_1	Rounded	15/60
			Pyriform	45/60
		BC_2F_1	Rounded	60/60
		F_2	Rounded	117/120
			Pyriform	3/120
	EC631378 x MHT0101	P_1: EC631378	Pyriform	30/30
		P_2: MHT0101	Slightly flattened	30/30
		F_1	Slightly flattened	30/30
		BC_1F_1	Slightly flattened	18/60
			Cylindrical	42/60
		BC_2F_1	Slightly flattened	60/60
		F_2	Slightly flattened	120/120

Table 2 continued...

Table 2 continued...

	EC631477 x Pusa Ruby	P_1: EC631477	Rounded	30/30
		P_2: Pusa Ruby	Rounded	30/30
		F_1	Rounded	30/30
		BC_1F_1	Rounded	60/60
		BC_2F_1	Rounded	60/60
		F_2	Rounded	120/120
	EC631455 x MHT0100	P_1: EC631455	Rounded	30/30
		P_2: MHT0100	Rounded	30/30
Predominant fruit shape	EC631455 xMHT0100	F_1	Rounded	30/30
		BC_1F_1	Rounded	60/60
		BC_2F_1	Rounded	60/60
		F_2	Rounded	120/120
Fruit size	EC632944 x MHT0101	P_1: EC632944	Small	30/30
		P_2: MHT0101	Small	30/30
		F_1	Small	30/30
		BC_1F_1	Small	26/60
			Intermediate	34/60
		BC_2F_1	Very small	3/60
			Small	54/60
			Intermediate	1/60
		F_2	Small	85/120
			Intermediate	35/120
	EC631378 x Pusa Ruby	P_1: EC631378	Intermediate	30/30
		P_2: Pusa Ruby	Intermediate	30/30
		F_1	Intermediate	30/30
		BC_1F_1	Intermediate	17/60
			Small	43/60
		BC_2F_1	Intermediate	24/60
			Small	36/60
		F_2	Intermediate	9/120
			Small	86/120
			Very small	25/120
	EC631378 x MHT0101	P_1: EC631378	Intermediate	30/30
		P_2: MHT0101	Intermediate	30/30
		F_1	Small	30/30
		BC_1F_1	Intermediate	14/60
			Small	46/60
		BC_2F_1	Intermediate	2/60

Table 2 continued...

Table 2 continued...

			Small	55/60
			Very small	3/60
		F_2	Intermediate	5/120
			Small	105/120
			Very small	10/120
	EC631477 x Pusa Ruby	P_1: EC631477	Intermediate	30/30
		P_2: Pusa Ruby	Small	30/30
		F_1	Intermediate	30/30
		BC_1F_1	Intermediate Small	9/60 51/60
		BC_2F_1	Intermediate	29/60
			Small	31/60
		F_2	Intermediate	18/120
			Small	102/120
Fruit size	EC631455 x MHT0100	P_1: EC631455	Small	30/300
		P_2: MHT0100	Small	30/30
	EC631455 x MHT0100	F_1	Intermediate	30/30
		BC_1F_1	Intermediate	3/60
			Small	57/60
		BC_2F_1	Intermediate	4/60
			Small	56/60
		F_2	Intermediate	13/120
			Small	107/120
Fruit size homogeneity	EC632944 x MHT0101	P_1: EC632944	Intermediate	30/30
		P_2: MHT0101	Intermediate	30/30
		F_1	Intermediate	30/30
		BC_1F_1	Intermediate	40/60
			High	20/60
		BC_2F_1	Intermediate	40/60
			High	20/60
		F_2	Intermediate	80/120
			High	40/120
	EC631378 x Pusa Ruby	P_1: EC631378	Intermediate	30/30
		P_2: Pusa Ruby	Intermediate	30/30
		F_1	Intermediate	30/30
		BC_1F_1	Intermediate	40/60
			High	20/60
		BC_2F_1	Intermediate	40/60
			High	20/60

Table 2 continued...

Table 2 continued...

		F_2	Intermediate	80/120
			High	40/120
	EC631378 x MHT0101	P_1: EC631378	Intermediate	30/30
		P_2: MHT0101	Intermediate	30/30
		F_1	Intermediate	30/30
		BC_1F_1	Intermediate	40/60
			High	20/60
		BC_2F_1	Intermediate	40/60
			High	20/60
		F_2	Intermediate	80/120
			High	40/120
	EC631477 x Pusa Ruby	P_1: EC631477	Intermediate	30/30
		P_2: Pusa Ruby	Intermediate	30/30
		F_1	Intermediate	30/30
		BC_1F_1	Intermediate	40/60
			High	20/60
		BC_2F_1	Intermediate	40/60
			High	20/60
		F_2	Intermediate	80/120
			High	40/120
Fruit sizehomogeneity	EC631455 x MHT0100	P_1: EC631455	Intermediate	30/30
		P_2: MHT0100	Intermediate	30/30
		F_1	Intermediate	30/30
		BC_1F_1	Intermediate	40/60
			High	20/60
		BC_2F_1	Intermediate	40/60
			High	20/60
		F_2	Intermediate	80/120
			High	40/120
Fruit shoulder shape	EC632944 x MHT0101	P_1: EC632944	Slightly depressed	30/30
		P_2: MHT0101	Slightly depressed	30/30
		F_1	Slightly depressed	30/30
		BC_1F_1	Slightly depressed	60/60
		BC_2F_1	Slightly depressed	60/60
		F_2	Slightly depressed	120/120
	EC631378 x Pusa Ruby	P_1: EC631378	Slightly depressed	30/30
		P_2: Pusa Ruby	Slightly depressed	30/30
		F_1	Slightly depressed	30/30

Table 2 continued...

Table 2 continued...

		BC_1F_1	Slightly depressed	60/60
		BC_2F_1	Slightly depressed	60/60
		F_2	Slightly depressed	120/120
	EC631378 x MHT0101	P_1: EC631378	Slightly depressed	30/30
		P_2: MHT0101	Slightly depressed	30/30
		F_1	Slightly depressed	30/30
		BC_1F_1	Slightly depressed	60/60
		BC_2F_1	Slightly depressed	60/60
		F_2	Slightly depressed	120/120
	EC631477 x Pusa Ruby	P_1: EC631477	Slightly depressed	30/30
		P_2: Pusa Ruby	Slightly depressed	30/30
		F_1	Slightly depressed	30/30
		BC_1F_1	Slightly depressed	60/60
		BC_2F_1	Slightly depressed	60/60
		F_2	Slightly depressed	120/120
	EC631455 x MHT0100	P_1: EC631455	Slightly depressed	30/30
		P_2: MHT0100	Slightly depressed	30/30
		F_1	Slightly depressed	30/30
		BC_1F_1	Slightly depressed	60/60
		BC_2F_1	Slightly depressed	60/60
		F_2	Slightly depressed	120/120
Fruit cross sectional shape	EC631378 x Pusa Ruby	P_1: EC631378	Round	30/30
		P_2: Pusa Ruby	Round	30/30
		F_1	Round	30/30
		BC_1F_1	Round	30/30
		BC_2F_1	Round	59/60
			Irregular	1/60
		F_2	Round	114/60
			Irregular	6/60
	EC631378 x MHT0101	P_1: EC631378	Round	30/30
		P_2: MHT0101	Round	30/30
		F_1	Round	30/30
		BC_1F_1	Round	57/60
			Irregular	3/60
		BC_2F_1	Round	58/60
			Irregular	2/60
		F_2	Round	117/120
			Irregular	3/120

Table 2 continued...

Table 2 continued...

	EC631477 x Pusa Ruby	P_1: EC631477	Round	30/30
		P_2: Pusa Ruby	Round	30/30
		F_1	Round	30/30
		BC_1F_1	Round	60/60
		BC_2F_1	Round	60/60
		F_2	Round	109/120
			Irregular	11/120
	EC631455 x MHT0100	P_1: EC631455	Round	30/30
		P_2: MHT0100	Round	30/30
		F_1	Round	30/30
		BC_1F_1	Round	50/60
			Irregular	10/60
		BC_2F_1	Round	52/60
			Irregular	8/60
		F_2	Round	103/120
			Irregular	17/120
Shape of pistil scar	EC632944 x MHT0101	P_1: EC632944	Stellate	30/30
		P_2: MHT0101	Stellate	30/30
		F_1	Stellate	30/30
		BC_1F_1	Stellate	56/60
			Irregular	4/60
		BC_2F_1	Stellate	53/60
			Irregular	7/60
		F_2	Stellate	108/120
			Irregular	12/120
	EC631378 x Pusa Ruby	P_1: EC631378	Dot	30/30
		P_2: Pusa Ruby	Dot	30/30
		F_1	Dot	30/30
		BC_1F_1	Dot	60/60
Shape of pistil scar	EC631378 x Pusa Ruby	BC_2F_1	Dot	50/60
			Stellate	8/60
			Irregular	2/60
		F_2	Dot	108/120
			Stellate	6/120
			Irregular	6/120
	EC631378 x MHT0101	P_1: EC631378	Dot	30/30
		P_2: MHT0101	Stellate	30/30
		F_1	Dot	30/30

Table 2 continued...

Table 2 continued...

		BC_1F_1	Dot	12/60
			Stellate	10/60
		Linear	48/60	
		BC_2F_1	Dot	27/60
			Stellate	7/60
			Linear	26/60
		F_2	Dot	41/120
			Stellate	8/120
			Linear	71/120
	EC631477 x Pusa Ruby	P_1: EC631477	Dot	30/30
		P_2: Pusa Ruby	Dot	30/30
		F_1	Dot	30/30
		BC_1F_1	Dot	48/60
			Irregular	12/60
		BC_2F_1	Dot	51/60
			Irregular	9/60
		BC_2F_1	Dot	51/60
			Irregular	9/60
		F_2	Dot	111/120
			Irregular	9/120
	EC631455 x MHT0100	P_1: EC631455	Stellate	30/30
		P_2: MHT0100	Stellate	30/30
		F_1	Stellate	30/30
		BC_1F_1	Stellate	60/60
		BC_2F_1	Stellate	60/60
		F_2	Stellate	120/120
Fruit blossom end shape	EC632944 x MHT0101	P_1: EC632944	Indented	30/30
		P_2: MHT0101	Flat	30/30
		F_1	Flat	30/30
		BC_1F_1	Flat	37/60
			Pointed	23/60
		BC_2F_1	Flat	32/60
			Pointed	28/60
		F_2	Flat	21/120
			Pointed	99/120
	EC631378 x Pusa Ruby	P_1: EC631378	Flat	30/30
		P_2: Pusa Ruby	Flat	30/30
Fruit blossom end shape		EC631378 x Pusa Ruby		F_1 Indented 30/30
		BC_1F_1	Indented	13/60

Table 2 continued...

Table 2 continued...

			Pointed	47/60
		BC_2F_1	Flat	6/60
			Indented	8/60
			Pointed	46/60
		F_2	Flat	112/120
			Indented	5/120
			Pointed	3/120
	EC631378 x MHT0101	P_1: EC631378	Flat	30/30
		P_2: MHT0101	Flat	30/30
		F_1	Flat	30/30
		BC_1F_1	Flat	46/60
			Pointed	14/60
		BC_2F_1	Flat	49/60
			Pointed	11/60
		F_2	Flat	111/120
			Indented	9/120
	EC631477 x Pusa Ruby	P_1: EC631477	Flat	30/30
		P_2: Pusa Ruby	Flat	30/30
		F_1	Flat	30/30
		BC_1F_1	Flat	52/60
			Indented	8/60
		BC_2F_1	Flat	55/60
			Indented	5/60
		F_2	Flat	111/120
			Indented	9/120
	EC631455 x MHT0100	P_1: EC631455	Flat	30/30
		P_2: MHT0100	Flat	30/30
		F_1	Flat	30/30
		BC_1F_1	Flat	54/60
			Indented	6/60
		BC_2F_1	Flat	54/60
			Indented	5/60
		F_2	Flat	107/120
			Indented	13/120

forms. EC631477 × Pusa Ruby and EC631455 × MHT0100 were predominantly flat, with some indented fruits appearing in backcross and F_2 generations.

The results were in accordance with Terzopoulos and Bebeli (2010), Bhattarai *et al.* (2018), Salim *et al.* (2020).

Conclusion

The study revealed that while growth habit, leaf type and inflorescence type remained largely stable across generations, fruit-related traits such as size, shape and scar characteristics showed considerable segregation. This variability highlights the influence of both additive

and non-additive gene actions in trait expression. The observed patterns provide a clear understanding of inheritance behaviour, which can guide effective parental selection. These insights are valuable for designing breeding strategies aimed at improving fruit quality and uniformity in tomato.

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