SHORT COMMUNICATION

Morphological Characterization of Tomato Varieties

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Characterization provides information about genetic diversity between two varieties at morphological as well as molecular level. The varying qualities and characters of different varieties created an interest to identify them. With the proliferation of newly developed varieties in tomato, the task of establishing identity of these varieties and of maintaining the seed purity has become a major concern. The visual identification and separation of varieties on the basis of seed morphology is the simplest and quickest method. However, in crop like tomato, the seed morphological polymorphism is too narrow to classify. Therefore, growing the crop for morphological observations on seedling, plant and fruit characters become obvious. The International Union for the Protection of New Varieties (UPOV) has prepared guidelines for varietal characterization in crops including tomato. Morphological characters such as growth habit (Tewari and Chaudhary, 1990), number of locules (Singh *et al.*, 1974) and fruit shape (Tay and Chen, 1993) in tomato have been used for varietal characterization. The present study was aimed at elucidating information on the extent of use of morphological characters for varietal characterization in tomato.

Twenty-two commercial varieties and three hybrids of tomato (Table 1) were grown in two replications of 25 plants each under field conditions at IARI during 1999 and 2000. Important morphological characters, classified as essential, as per UPOV guidelines for DUS testing in tomato, were selected for characterization and observations were recorded visually at different growth

Table 1. Seed sources of varieties under study for characterization

Variety	Seed Source	Pedigree
Pusa Sheetal	IARI, New Delhi	699 x Balkan
Pusa 120	IARI, New Delhi	Anahu
Pusa Gaurav	IARI, New Delhi	Glamour x Watch
Pusa Early Dwarf	IARI, New Delhi	Improved Meeruti x Red Cloud
Pusa Ruby	IARI, New Delhi	Sioux x Improved Meeruti
Chikoo	IARI, New Delhi	Selection
Junagarh Ruby	IARI, Regional Station, Karnal	Big Silari x Pusa Ruby
Marglobe	IARI, Regional Station, Karnal	EC 54722 (T-2768)
Roma	IARI, Regional Station, Karnal	EC 54851 and directly released as variety IC 76310
Soiux	IARI, Regional Station, Karnal	American introduction/and directly released as variety IC 76313
Best of All	IARI, Regional Station, Karnal	American introduction/and directly released as variety IC 76311
Arka Abha	IIHR, Bangalore	Pure line Selection (VC-8-1-21AVRDC Taiwan)
Arka Meghali	IIHR, Bangalore	Pedigree selection (F$_8$), from cross Arka Vikas x IIHR-554
Arka Saurabh	IIHR, Bangalore	Selection from Canadian Breeding line V-685
Arka Vikas	IIHR, Bangalore	Selection from American variety Tip Top
PKM-1	TNAU, Coimbatore	An induced mutant from Annaji tomato
CO-3	TNAU, Coimbatore	EMS induced mutant of CO-1
CO-2	TNAU, Coimbatore	Pure line isolated from USSR type
Hisar Arun	HAU, Hisar	PED x K-1
Hisar Lalit	HAU, Hisar	Resistant Bangalore (RB) x HS -101
Pant Bahar	GBPUAT, Pantnager	Selection from germplasm line AC-238
Pant T-3	GBPUAT, Pantnager	Selection from germplasm line AC 292
Pusa Hybrid-1	IARI, New Delhi	Pusa Sheetal x Chikoo
Pusa Hybrid-2	IARI, New Delhi	Pusa – 120 x Pusa Gaurav
Pusa Hybrid-4	IARI, New Delhi	Pusa – 120 x Chikoo

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stages. In addition to the UPOV characters, plant growth habit was also included (Tewari and Chaudhary, 1990).

The result on classification of twenty-two varieties and three hybrids based on plant and fruit characters has been presented in Tables 2 and 3. The twenty-five morphological characters recorded at different growth stages revealed that no single character could classify the cultivars individually except the shape of fruit which were typicall in Pusa Gaurav (plum), Chikoo (heart) and Roma (pear). However, it was possible to identify a cultivar using a set of characters in sequence.

The study revealed that there was no variation for the characters like anthocyanin pigmentation on seedling leaf, leaf division, style pubescence, flower colour and epidermis of fruit in all the varieties and hybrids (Table 2 and 3). Hence, such characters could not be relied upon for classifying the tomato varieties. These results are in conformity with the results of Ilame (1994).

In the present investigation, the characters viz., locules per fruit, fruit shape, plant type, stem flexibility and pericarp thickness were reliable to reproduce. Similar findings were also reported by Singh *et al.* (1974), Kaur

Table 2. Characterization of tomato cultivars based on plant characters (90 days after transplanting)

Cultivars	Plant growth type	Stem pubescence	Stem flexibility	Leaf pose	Leaf colour	No. leaves under 1st inflorescence at 70 DAT
Pusa Sheetal	D	W	F	H	Mg	Fe
Pusa 120	Sd	W	F	Se	Dg	Ma
Pusa Gaurav	D	W	If	Se	Mg	Ma
Pusa Early Dwarf	D	W	If	H	Mg	Ma
Pusa Ruby	I	W	F	H	Dg	Ma
Chikoo	D	W	F	H	Lg	Ma
Junagadh Ruby	I	M	F	Se	Dg	Ma
Marglobe	I	W	F	Se	Mg	Ma
Roma	D	W	F	H	Lg	Fe
Soiux	I	W	F	Se	Mg	Ma
Best of All	I	M	F	H	Mg	Fe
Arka Abha	Sd	W	F	H	Mg	Ma
Arka Meghali	Sd	M	F	H	Dg	Ma
Arka Saurabh	Sd	W	F	H	Lg	Ma
Arka Vikas	Sd	W	If	Se	Dg	Ma
PKM-1	D	W	F	H	Mg	Ma
CO-3	Sd	W	If	Se	Mg	Fe
CO-2	I	W	If	Se	Mg	Ma
Hisar Arun	D	W	F	H	Mg	Fe
Hisar Lalit	Sd	W	F	Se	Dg	Ma
Pant Bahar	I	M	F	H	Mg	Ma
Pant T-3	Sd	W	F	H	Mg	Fe
Pusa Hybrid-1	D	W	If	Se	Mg	Fe
Pusa Hybrid-2	Sd	W	If	Se	Dg	Ma
Pusa Hybrid-4	Sd	W	If	Se	Mg	Ma

D=Determinate, Dg=Dark green, F=Flexible, Fe=Few, H=Horizontal, I=Indeterminate, If=Inflexible, Lg=Light green, M=Medium. Ma=Many, Mg=Medium green, Sd=Semi-determinate, Se=Semi-erect, W=Weak

et al. (1976), Ilame (1994) and Tewari (1996) in tomato respectively.

Further, the stem pubescence was observed to be useful in grouping the varieties. This qualitative trait, less affected by environment can form an important component of tomato varietal identification. Thus, from this study it is evident that characterization helps in realizing the genetic potential of the varieties. In addition classification of growth type will help the breeders while formulating the programme for development of hybrids for specific traits like days to flowering, duration of flowering and synchronization of flowering.

References

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Table 3. Characterization of tomato cultivars based on fruit characters (135 days after transplanting)

Cultivar	Fruit Size	Fruit shape	Fruit ribbing At calyx	Length of pedicel	Pedicel area pistil scar	Pedicel scar end	Shape of the	Shape of blossom	Transverse section	No. of locules	Pericarp thickness
Pusa Sheetal	M	Sf	Sl	Sh	Dp	M	D	In	An	3	Tn
Pusa 120	L	R	M	Lo	F	L	D	F	Ir	3	Tc
Pusa Gaurav	M	Pl	A	Lo	F	S	D	F	R	1	Tc
Pusa Earky Dwarf	S	R	A	Sh	F	S	D	F	R	2	Tn
Pusa Ruby	M	R	Sl	Sh	Dp	S	D	In	An	4	Tc
Chikoo	M	H	Sl	Lo	F	S	Ste	P	R	1	Tc
Junagadh Ruby	S	Hr	Sl	Sh	F	S	D	F	R	2	Tn
Marglobe	M	R	Sl	Lo	Dp	L	Ste	F	R	4	Tn
Roma	M	Pe	M	Lo	F	M	D	P	R	1	Tc
Soiux	M	R	M	Lo	Dp	M	Ir	In	An	4	Tn
Best of All	M	R	M	Sh	F	S	D	F	R	3	Tc
Arka Abha	M	R	Sl	Sh	Dp	M	Ste	In	R	4	Tn
Arka Meghali	M	R	Sl	Lo	Dp	S	Li	In	Ir	4	Tc
Arka Saurabh	L	R	Sl	Sh	Dp	S	Ir	F	Ir	4	Tc
Arka Vikas	M	Sf	Sl	Sh	Dp	S	Ir	In	An	4	Tc
PKM-1	M	R	Sl	Sh	Dp	S	Li	In	An	3	Tc
CO-3	M	R	M	Lo	Dp	M	D	F	Ir	4	Tc
CO-2	L	R	M	Lo	Dp	L	Li	F	Ir	4	Tn
Hisar Arun	M	Sf	Sl	Lo	Dp	S	D	In	An	3	Tc
Hisar Lalit	M	Sf	M	Sh	Dp	M	Ir	In	An	4	Tc
Pant Bahar	M	Sf	Sl	Sh	Dp	S	Ir	In	An	3	Tc
Pant T-3	M	R	Sl	Sh	Dp	S	Ste	F	R	3	Tc
Pusa Hybrid-1	M	Hr	Sl	Lo	Dp	M	D	F	R	3	Tc
Pusa Hybrid-2	M	Hr	Sl	Lo	F	S	D	F	R	2	Tc
Pusa Hybrid-4	M	Hr	Sl	Lo	F	M	D	F	R	3	Tc

A: Absent, An: Angular, C: Crimson, D: Dot, Dp: Depressed area, F: Flat, H: Heart, Hr: Highly round, In: Indented, Ir: Irregular, L: Large, Li: Linear, Lo: Long, M: Medium depressed, P: Pointed, Pe: Pear, Pl: Plum, R: Round, S: Small, Sf: Slightly flat, Sh: Short, Sl: Slight, Ste: Stellate, Tn: Thin, Tc: Thick, 1: Generally two; occasionally three, 2: Generally two frequently three, 3: Generally 3 or 4, 4: Generally > 4.

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