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Assessment of Genetic Variability for Morphological and Quality Traits in Tomato (*Lycopersicon esculentum.* Mill.)

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ABSTRACT: *The investigation was carried out in the thirty six genotypes of tomato for morphological and quality traits. Wide variability was observed for morphological traits like colour of the fruit and shape of fruit. The estimates of genetic parameters revealed that high phenotypic and genotypic coefficient variation for acidity and lycopene content and medium GCV and PCV for total soluble solids. High heritability was coupled with high genetic advance as per cent mean was noticed for all the three quality characters.The germplasm used could be a resource of good quality in breeding programmes.*

Key words*: genotype, variability, heritability, genetic advance*

INTRODUCTION

The tomato is the fruit of the plant *Lycopersicon* esculentum. The botanical name *Solanum lycopersicum* for tomatoes has now largely been replaced by the name *Lycopersicon esculentum*. It is self pollinated crop species having diploid chromosome number of 2n=24. The cultivated tomato occurs within a clad of ~13 closely related species, which have been instrumental in the development of the crop as model system. They are excellent source of variability in qualitative and nutritional value and are easily utilised in crop breeding programme.

Regardless of its name, the tomato is a wonderfully popular and versatile food that comes in over a thousand different varieties that vary in shape, size, and colour. There are small cherry tomatoes, bright yellow tomatoes, Italian pear-shaped tomatoes and the green tomato, famous for its fried preparation. Different colour of tomatoes provides outstanding nutrient benefits. Although tomatoes are fruits in a botanical sense, they don't have the dessert quality sweetness of other fruits. Instead they have a subtle sweetness that is complemented by a slightly bitter and acidic taste. Tomatoes are widely known for their outstanding antioxidant content. Intake of tomatoes has long been linked to heart health. Fresh tomatoes and tomato extracts have been shown to help lower total cholesterol, LDL cholesterol, and triglycerides. In addition, tomato extracts have been shown to help prevent unwanted clumping together (aggregation) of platelet cells in the blood-a factor that is especially important in lowering risk of heart problems like atherosclerosis.

Although lot of work has been done to know the variability in quantitative characters related to yield, but less work has reported on morphological and quality traits variability.

MATERIALS AND METHODS

Thirty six tomato genotypes are evaluated in randomized block design at college of Agriculture Navile, Shivamogga during late *kharif* Season of 2014.Nursery plants are raised in polytrays and 25-28 days seedlings are transplanted to main field. Five plants were selected from each genotypes for recording the observations. Tomato genotypes were harvested at the optimum ripeness stage between 9:00 and 11:00 am and immediately used for analysis.

In order to evaluate morphological variability five fruits are selected from each plant and observed variations in shape of the fruits and colour of the fruit. These are estimated based on the fruit shape categories adopted from UPOV 2001 and IBPGR 1996.The colour of the fruit was determined based on the colour chart given by Variations Horticultural Services DBA Michigan Heirlooms.

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Total soluble solids content of fruit (TSS)

Tomato juice was collected from red ripe fruits. A drop of juice was placed over the prism of hand refractometer and brix value was noted at room temperature.

Acidity

Total acid is usually determined by titrating an aliquot of sample with a base of known strength using a suitable indicator to determine the end point. The acidity is usually calculated and reported in terms of the predominant acid like citric acid [1].

Reagents : 1. Sodium hydroxide: 0.1 N, 2. Phenolphthalein indicator: Dissolve 1 g of indicator in 60 ml of 95 per cent ethyl alcohol and dilute to 100 ml with distilled water.

Preparation of sample : In order to secure a sample of the water soluble acids, the fresh fruits must be crushed. This can be accomplished by placing the fruit in a small hand-operated press type juice extractor or a layer of cheese cloth and squeezing it tightly until the pulp is fairly *dry*. If the juice sample contains fibers and particles, the liquid should be centrifuged or filtered until the juice is clear.

Procedure : Weigh 25 g of macerated sample or pipette a 25 ml sample and transfer to a 250 ml volumetric flask. Dilute to 100 ml with distilled water. Shake and filter through Whatman No. 4 filter paper. Pipette 50 ml of the filtrate into a 250 ml Erlenmeyer flask and add 50 ml of distilled water. Add 0.3 ml of 1% phenolphthalein solution and titrate with 0.1N sodium hydroxide solution until the pink color develops. Record the volume of the sodium hydroxide used and calculate the acidity.

Calculations

As per cent of acid (titrating with 0.1 N NaOH)

% Acid used= ml of 1N NaOH x dilution factor

Lycopene content : Lycopene has absorption maxima at 473 nm and 503 nm. One mole of lycopene when dissolved in one litre light petroleum ether (40-60^{0}C) and measured in a spectrophotometer at 503 nm in 1 cm path gives an absorbance of 17.2 x 104. Therefore, a concentration of 3.1206 ìg lycopene per ml gives unit absorbance [1].

Reagents :1. Petroleum ether (40^0-60^{0}C)

2. 5% sodium sulphate: Prepare by dissolving five g anhydrous sodium sulphate in 100 ml solution and 3. Acetone

Procedure : Take 3-4 tomato fruits and pulp it well to a smooth consistency in a waring blender. Weigh 5-10 g of this pulp. Extract the pulp repeatedly with acetone using pestle and mortar until the residue is colorless. Pool the acetone extracts and transfer to separating funnel containing about 20ml petroleum ether and mix gently. Add about 20ml of 5% sodium sulphate solution and shake the separating funnel gently. Volume of petroleum ether might be reduced during these processes because of its evaporation. So, add 20ml petroleum ether to the separating funnel for clear separation of two layers. Most of the color will be noticed in the upper petroleum ether layer. Separate the two phases and re-extract the lower aqueous phase with additional 20ml petroleum ether until the aqueous phase is colorless. Pool the petroleum ether extracts and wash once with a little distilled water. Pour the washed petroleum ether extract containing carotenoids into a brown bottle containing about 10 g anhydrous sodium sulphate to remove moisture. Keep it aside for 30 minutes or longer. Decant the petroleum ether extract into 100ml volumetric flask through a funnel containing cotton wool. Wash sodium sulphate slurry with petroleum ether until it is colorless and transfer the washings to the volumetric flask. Make up the volume and measure the absorbance at 503 nm using petroleum ether as a blank.

Calculations

$$\text{Lycopene content (mg/100g)} = \frac{(3.1206 \times \text{absorbance}) \times \text{dilution factor}}{\text{Weight of sample (g)}}$$

STATISTICAL ANALYSIS

The data collected on all the quality traits were subjected to basic analysis by following randomized block design and different statistical parameters were worked out. Analysis was done using Indo stat computer software.

RESULTS AND DISCUSSION

Tomato genotypes of diverse origin were characterised with respect to colour of the fruit and shape of the fruit. Variations observed in the morphological traits are presented in the Table 1.Qualitative characters are having great importance as they have show high heritability and stable expression. Further, association of any qualitative characters with yield component serves as a marker in selection processes.

The variability in two morphological characters *viz.*, colour of fruit and shape of fruit present in tomato germplasm is discussed. The genotypes showed high variability for colour of fruit, irrespective of different colours all these were grouped into Red (33.33 %),

accounting numerically higher than dark red(19.44%), red and yellow (19.44%), orange (13.88%) and red and green (08.33%) and only one genotype is contributed towards brown (02.77%) and pink (02.77) colour. In respect of shape of the fruits is an important trait, which is classified into different types such as round (63.89%), followed by flat (22.22), obovoid (5.55%), ellipsoid (2.78%), oxaheart (2.78%) and rectangular (2.78%). Maximum genotypes showed round shape which is most desirable type of shape [2].

Analysis of variance showed significant differences for all characters. Total soluble solids ranged from 5.00^0 Brix (AR-17) to 9.70^0 Brix (Black price) with a mean of 6.93^0 Brix. The PCV and GCV were 15.82 and 15.79 respectively. High heritability (96.60 per cent) was coupled with moderately high genetic advance as per mean (32.47 per cent) were observed. These are similar to the findings of Joshi [3] and Sahanur [4].The variation of 12.10 per cent (SL-120) to 60.00 per cent (Cherry tomato L-01696) with over all mean of 31.67 per cent was observed for acidity.PCV and GCV were 35.04 and 34.27 per cent respectively. High heritability of 93.00 per cent coupled with 68.07 per cent of genetic advance as per cent mean. A wide range of variability was observed for lycopene content. Which ranged from 0.20 mg/ 100g(Cherry tomato L-04780) to 22.49 mg/100g (SL-120)with over all mean of 9.22 mg/100g. High PCV and GCV were 72.50 and 72.22 per cent respectively. Very high heritability (99.90 per cent) was coupled with high genetic advance as per cent mean (149.24 per cent) was noticed for lycopene content and acidity. Similar results were obtained by Kumar [5] and Kumar [6].

High heritability of these traits indicate that variation generated is mainly due to genetic and role of environmental factors and clearly indicate that the improvement of the above traits can be obtained by simple selection in the present set of material.

Table 1
Variation for morphological characters (qualitative characters) in 36 tomato genotypes

Sl.No	*Character*	*Number of genotypes*	*Percent genotypes*	*Sl. No*	*Character*	*Number of genotypes*	*Percent genotypes*
1	Colour of fruit			2	Shape of fruit		
a	Dark red	7	19.44	a	Round	23	63.89
b	Red	12	33.33	b	Flat	8	22.22
c	Red and Green	3	08.33	c	Obovoid	2	05.55
d	Brown	1	02.77	d	Ellipsoid	1	02.78
e	Red andYellow	7	19.44	e	Oxaheart	1	02.78
f	Orange	5	13.88	f	Rectangular	1	02.78
g	Pink	1	02.77		**Total**	**36**	**100**
	Total	36	100				

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