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QUALITY ATTRIBUTES OF TOMATO GENOTYPES UNDER PROTECTED ENVIRONMENT

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Abstract– Tomatoes are an important part of a healthy human diet. The productivity and quality of the produce are being measured by using advanced production technologies. Protected cultivation is an advanced agro-technology that is utilized all over the world to generate high quality output. Indeterminate tomato is a growing crop though, still, in Punjab, no systemic work has been done for the evaluation of quality attributes of indeterminate tomato genotypes under the protected environment. Inherent diversity is a chief concern for the improvement of quality attributes in tomato. Considering the importance of tomatoes, there is an urgent need to screen out genotypes of indeterminate tomato for a best quality production and for higher nutritive value. The investigation was carried out at the Department of Vegetable Science of Agriculture, Khalsa College, Amritsar, Punjab, India and the experiment were conducted under modified naturally ventilated polyhouse following Factorial Randomized Block Design with three replications, consisting twelve genotypes including standard check during spring-summer season, 2020-2021. The data exhibited significant variation in twelve genotypes for different characters. Based on mean performance, the result let out that Punjab Gaurav and JC-165 was superior for all the quality attributes. Whereas, pericarp thickness and fruit shape index were maximumin KCA-2 while Punjab Sartaj was sophisticated for TSS, lycopene and ascorbic acid although greater titrable acidity was recorded in Arka Vikas. Significantly, result was higher due to the favorable conditions provided in a protected environment during growing period with the interaction of genes of genotype.

INTRODUCTION

Tomato (*Solanum lycopersicum* L.*)* is a member of solanaceae family with chromosome number 2n=24 (Miller *et al.,* 1990). Cultivated tomato is originated from Western South America and arrived in India with Portuguese and probably used for human consumption in 17th century (Kalloo, 1991; Rick, 1976). In India, it is cultivated in an area of 8.51 lakh hectare with total production of 210.02 lakh tonnes (Anonymous, 2021). Tomato is generally known as protective food and it is widely developed all around the world both for fresh market and processing. Tomato has achieved a status of high value crop in India and possesses a pride place among vegetables in Indian cooking due to its delicacy and lovely flavor. Tomato fruits are rich in lycopene content and plays a significant role in preventing cancer and reducing the risk of heart diseases. Tomato pulp and juice are consumable, promot of gastric secretion and blood purification.

Presently, tomato cultivation in open fields is very common but open condition needs more attention or to control the crop against biotic (pest and disease) and abiotic (rainfall, temperature, relative humidity and light intensity) stresses or agronomical practices for better quality attributes (Sanwal *et al.,* 2008). Tomato, being a high value and low volume crop, its exploitation on commercial scale in naturally ventilated polyhouse can improve the productivity and also enhances the quality and nutrition of produce and provide incredible return to ranchers from a small piece of land. Hence, the main objective of the current investigation was directed to study the virtual performance of tomato genotypes for quality characters under protected conditions.

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MATERIALS AND METHODS

The research investigation was assessed on twelve tomato genotypes explicitly Arka Vikas, Punjab Gaurav, Arka Saurabh, Punjab Sartaj, KCA-1, KCA-2, EZ-9003, Yuvraj 1003, JC-165, Heemsona and NS-4266 and one standard check (Punjab Swarna). Soil less media is used in equal proportion 3:1:1 (cocopeat: perlite: vermiculite) to raise the nursery in pro trays and healthy seedlings (at 2 to 3 leaf stage) are transplanted during evening hours in modified naturally ventilated polyhouse after 35 days of sowing. Cultural practices are followed during the crop growing period as per package of practices specifically, irrigation, fertigation, earthing up, fertilization, stacking and crop protection measures. The observations were recorded on seven plants taken randomly for the characters namely, pericarp thickness (mm), fruit shape index, total soluble solids (°Brix), lycopene (mg), ascorbic acid (mg) and titrable acidity (%). The data for different traits were analyzed statistically to work out an analysis of variance and mean performance as per the method (Cochran and Cox 1963).

RESULTS AND DISCUSSION

Pericarp Thickness (mm)

Pericarp thickness is very imperative parameter in tomato fruits, as thicker pericarp is necessary for longer shelf life and transportation. There were significant differences among the hybrids for the trait and the maximum pericarp thickness was observed in line KCA-2 whereas hybrid NS-4266, Punjab Gaurav, EZ-9003 and variety Punjab Swarna were found statistically at par (Table 1). Variation might be because of the genetic makeup of genotypes. These finding are assisted by Khapte and Jansirani (2014); Prakash *et al.* (2019); Mohmoud and Khaili (2019); Sinha *et al.* (2020) and Kumari and Patil (2021).

Fruit Shape Index

Fruit shape and size is important not only for the consumer but also for the market point of view. Significant variations were recorded for fruit shape index. The maximum fruit shape index was observed in line KCA-2 which was statistically superior among other genotypes, whereas, variety Punjab Swarna, check Punjab Gaurav and Arka Vikas was statistically at par. The present studies revealed that out of 12 genotypes 7 hybrids were flat round (EZ-9003, Yuvraj 1003, JC-165, Heemsona, NS-4266, Arka Saurabh, Punjab Sartaj), 4 were of round shape (KCA-1, Arka Vikas, Punjab Swarna and Punjab Gaurav) and 1 hybrid was oval in shape (KCA-2) (Table 1). This character is steady and not inclined by biotic and abiotic stresses. Variation in fruit shape index totally depends upon the genes of genotype. Likewise, tomato genotypes were also classified into oval, spherical, round and flat round categories in prior studies by Dhaliwal and Jindal (2018); Shiksha 2018; Dhillon *et al.* (2019); Kumar and Rana (2021).

Total Soluble Solids (°Brix)

Sophisticated total soluble solids are a necessary quality attribute for tomato in processing as well as

Table 1. Mean performance of indeterminate tomato hybrids forquality traits.

Hybrids	Pericarp thickness (mm)	Fruit shape index	Total Soluble Solids (°Brix)	Ascorbic acid (mg)	Lycopene (mg)	Titrable acidity (%)
EZ-9003	4.76	0.84	4.83	26.86	4.49	0.98
Yuvraj 1003	4.28	0.76	4.14	24.48	4.67	0.59
JC-165	3.59	0.78	5.24	35.81	4.61	1.08
Heemsona	4.17	0.73	4.91	20.26	4.41	0.49
NS-4266	5.01	0.86	5.13	27.85	4.58	0.78
KCA-1	4.36	0.93	3.94	17.36	3.38	0.69
KCA-2	6.16	1.18	3.70	18.31	1.68	0.42
Arka Vikas	3.91	1.03	4.30	29.41	2.58	1.38
Punjab Gaurav	4.92	1.04	5.28	31.52	4.70	0.36
Arka Saurabh	4.00	0.84	4.06	21.84	4.37	1.28
Punjab Sartaj	3.82	0.76	5.77	33.63	4.64	0.28
Punjab Swarna (check)	4.48	1.09	3.85	19.28	3.21	0.21
C.D. ($p \leq 0.05$)	0.60	0.03	0.20	2.13	0.22	0.08

for fresh consumption. Hybrids discovered significant differences for this trait. Highest TSS was found in variety Punjab Sartaj and lowest TSS found in line KCA-2(Table 1). The alterations in total soluble solids were due to variations in genotypes and environmental conditions conquered during the growing season. Substantial variability among the tomato genotypes for this character was also observed by many former researchers explicitly, Cheema *et al.* (2013); Singh *et al.* (2019) and Sinha *et al.* (2020).

Lycopene (mg)

Visible fruit color of tomato is one the most important quality parameters for consumers as it conveys attractive red color due to predominant constituent pigment, lycopene. Mean values for different hybrids revealed that check Punjab Gaurav acquired maximum content of lycopene and hybrid Yuvraj-1003, variety Punjab Sartaj and JC-165 were found statistically at par due to the optimum temperature inside the polyhouse during its color development and pigmentation. Former researchers also discovered similar results specifically, Dar and Sharma (2011), Triveni *et al.* (2017), Dhaliwal and Jindal (2018) and Eppakayala *et al.* (2021).

Ascorbic acid (mg)

Ascorbic acid content is one of the chief quality components in tomato as it improves the nutritional quality of fruit. Among entirely genotypes, the hybrid JC-165 acquired maximum content of ascorbic acid. The variety Punjab Sartaj, check Punjab Gaurav and Arka Vikas were statistically at pardue to favorable conditions provide in polyhouse and genetic makeup of the genotype. These findings are backed up by Jindaland Dhaliwal (2018); Mahmoud and Khalil (2019) and Kumar and Rana (2021).

Titrable acidity (%)

Tomato fruits with low acidity are preferred for fresh table purpose but higher acidity is important for processing industry. Hence, fruits with both categories bring value in the market. The maximum value for titrable acidity was noticed in variety Arka Vikas which was statistically at par variety Arka Saurabh, hybrid JC-165 and EZ-9003 because of providing optimum microclimate with the interaction of genetic makeup of genotype, while on the other hand, reported lowest acidity in variety Punjab Swarna. Similar results were obtained by Venkadeswaran *et al.* (2018), Sinha *et al.* (2020) and Mounica *et al.* (2022).

CONCLUSION

Under polyhouse conditions, indeterminate tomato genotypes performed well for quality and its related characters due to favorable condition which positively impacted the morpho-phenological and physiological traits of tomato plants. Among all the genotypes, Punjab Gaurav and JC-165 accomplish finest quality for all the attributes although Punjab Sartaj was superior by acquiring higher TSS, content of lycopene and ascorbic acid but Arka Vikas was best by gaining maximum titrable acidity. However, fruit surface quality like pericarp thickness and fruit shape index was noted supreme in line KCA-2.

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