



Morphological Characterization of Tomato Genotypes (*Solanum lycopersicum* L)

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ABSTRACT

Tomato belongs to the family Solanaceae, grown worldwide for its edible fruits, ranging in different shapes and sizes, and colours from red to green and black among others. Tomato is grown mostly in the Northern part of Nigeria during dry seasons under irrigation. Tomato is one of the major components of food in Nigeria. The research aim at identifying the genetic diversity among tomato genotypes with view in finding the evolutionary relationship among the selected tomato genotypes. Tomato genotypes seeds which includes landraces and accessions were used for the study. The genetic diversity studies were done using International Plant and Genetic Resource Institute (IPGRI) the descriptors of tomato protocols and manuals. However, the fruit shelf life was also been evaluated in the study. Two growth patterns (determinate and indeterminate) were identified among the genotypes evaluated. Potato leaf type is the dominant leaf shape among the genotypes of study. Different fruit shapes such as oblong, pyriform, rounded were identified among others. Some of the landraces shows short shelf shelves. In conclusion, the research identified the variations and distinctiveness of tomato genotypes grown in Sokoto agro-climatic zone of Nigeria and identified some genotypes with long shelve life. This could be used as a tool in cultivating tomato with high resilience of storage.

Keywords: tomato, genotypes, morphology, shelve life.

1.0 INTRODUCTION

Tomato belongs to Family: *Solanaceae* Genus: *Solanum* Species: *Solanum lycopersicum* (Allen, 2008). Tomato is now grown worldwide for its edible fruits with thousands of cultivars produce red fruits; but a number of cultivars with yellow, orange, pink, purple, green, black or white fruits are available. The tomato belongs to the nightshade family Solanaceae, the species originated in Central and South America and its use as a food, and spread throughout the world following the Spanish colonization of the Americas (AVRDC, 1990).

In Nigeria tomato production faces a lot problems both in the farm and in store. This problems are associated with selection of right cultivars. Cultivars with high degree of tolerance to both biotic and abiotic stress. And those with high shelve life. Tomato produced succulent fruits that are vulnerable to damage at harvest by pathogens, pest or environmental factors. Hence the need for selecting cultivar with long shelves life (Ja'afar *et al.*, 2019).

About 750000 metric tons of tomato are estimated as annual loss of tomato in Nigeria due to problems associated with storage, transportation and price instability among others (Ja'afar *et al.*, 2019).

Nigeria is the largest producer of tomato in Sub-Saharan Africa and 13th in the world with an annual output of 2.4 million tones. Notwithstanding, the production faces challenges with distribution, storage, biotic and abiotic stress (Bair and Peters, 2006).

2.0 MATERIALS AND METHODS

2.1 Plant Materials and Experimental Design

The seeds of the different selected landraces tomato and accessions genotypes were obtained from Institute for Agricultural Research Zaria. The seeds of the tomato genotypes were sown in the nursery bed and uniformly germinated seedlings (2 week old) were selected and transplanted into poly bags containing mixture of sand and organic manure 3:1.

The experiment was laid down in a completely randomized design Ja'afar and Aliero, 2015).

2.2 Phenotypic Evaluation

Plants morphological characteristics, growth and yield of the twenty selected tomato genotypes were determined using International Plant Genetic Resource Institute Descriptors of Tomato Chart (IPGRI, 2005).

2.3 Determination of Fruit Size and Weight of Fruit at Harvest

The size of the fruit was determined according to IPGRI descriptors of tomato chart (IPGRI, 2014). The length was recorded from stem end to blossom end, to one decimal place at maturity (when the fruit is fully ripened). The fruit width was recorded at the largest diameter of cross-sectioned fruits to one decimal place, at maturity. Fruits < 3cm were described as very small while 3-5cm small, 5.1- 8cm intermediate, 8.1- 10 cm large and > 10 cm were described as very large respectively. The weight of fruit of each plant at different treatments was determined by weighting all the fruits in gram using weighing scale model CBB 600 (Van Hintum, 1993).

2.4 Determination of Fruit Shelf Life

The shelf life of the fruits from different cultivars was determined by keeping the fruits at room temperature

(35±2°C, for 10 days after harvesting, fruits that keep between 5 – 8 days is considered to have long shelf life, 3- 5 days medium shelf life and 0- 3 days short shelf life (IPGRI, 2015).

2.5 Determination of Leaves Type and Leaves Shape

Leaves type and leave shapes were determine using International Plant and Genetic Resource Institute the descriptors of tomato charts and manual (IPGRI, 2015).

3.0 RESULTS

3.1 Genetic Diversity Based on Phenotypic Characterization

Among the twenty genotype of tomato used for this study, ten had determinate growth type while the other ten had indeterminate growth type (Table 1). The following leaves types were recorded, one dwarf type, one hirsutum, pervianum, two bipinnate and 15 potato leaf types (Plate I). Nine different fruit shapes were recorded among the twenty accessions, these include rounded, slightly flattened, high rounded and globe among others (Plate IIa&b). Eleven out of the twenty accessions had intermediate fruit size, six had small fruits, and two had large fruits while only one had very small fruits (Table 1). Five of the twenty cultivars had short shelf life (between 0-3 days), seven had medium shelf life (3-5 days) and eight had long shelf life between 5-10 days (Table 1).

Genotype	Growth habit	Fruit shape	Fruit size	Leaf type	Shelf life
Dangainakawa	Determinate	Pyriform	Very small	Dwarf	Short
Bahaushhe	Indeterminate	Slightly flattened	Intermediate	Potato leaf type	Short
Dandino	Indeterminate	High round	Small	Potato leaf type	Long
Dan Eka	Indeterminate	Pyriform	Intermediate	Potato leaf type	Medium
Dan Gombe	Indeterminate	Slightly flattened	Small	Potato leaf type	Medium
Dan mazari	Indeterminate	Oblong	Small	Potato leaf type	Medium
Dan dubu kamiya	Determinate	Rounded	Small	Potato leaf type	Short
Dan Kwandawa	Determinate	Slightly flattened	Intermediate	Potato leaf type	Medium
Ganwon Falke	Determinate	Flattened	Large	Potato leaf type	Short
Dan Dogarawa	Indeterminate	Slightly flattened	Intermediate	Potato leaf type	Short
Roma	Determinate	Ellipsoid	Intermediate	Potato leaf type	Long

UTC	Indeterminate	Globe	Intermediate	Potato leaf type	Long
Rio grande	Determinate	High rounded	Intermediate	Pervianum	Long
Giofranco F	Determinate	Slightly flattened	Intermediate	Potato leaf type	Medium
UC82B	Determinate	Globe	Intermediate	Potato leaf type	Long
Indian tomato	Indeterminate	Oblong	Small	Potato leaf type	Long
Tomato peto	Determinate	Ellipsoid	Intermediate	Bipinnate	Long
Tropimech	Indeterminate	Rounded	Intermediate	Hirsutum	Medium
Cherry	Indeterminate	Rounded	Small	Potato leaf type	Medium
Heirloom	Indeterminate	Flattened	Intermediate	Potato leaf type	Medium

Table 1. Growth Habit, Pre -dominant Fruit Shape, Leave Type, Fruit Size and Shelf Life of Tomato Genotypes Studied.



Plate I: Types of Tomato Leaves. A- Potato leaf type, B- Peruvianum, C- Bipinnate and D- Hirsu



Plate IIa: Types of Fruit Shape in Tomato Accessions and Landraces Studied. A: Ellipsoid B: Slightly flattened C: High round D: Oblong E: Pyriform F: Rounded.



Plate IIb: Types of Fruit Shape in Tomato Accessions and Landraces Studied. G: Slightly flattened H: Globe I: Flattened J: Pyriform.

4.0 DISCUSSION

The present study shows that out of the twenty tomato cultivars selected, eleven (11) shows determinate growth with nine showing indeterminate growth. Bair and Peters (2006) reported that cultivars with indeterminate growth pattern recorded high yield due to the continuous growth of the plants there by producing numerous fruit compared to plant with determinate growth pattern.

This study identified different leaf types among the selected tomato genotypes. Potato leaf type is the dominant leaf type among the cultivars grown in the area of study. This is in contrast to the report of Wallace, (2013) where Bipinnate leaf type dominates the leaf type in northern Indonesia. This study also evaluated the shape of tomato fruits produced by the respective cultivars, ranging from round to highly rounded, flat to slightly flattened among others. These shapes are however reported in USA to America as reported by Allen, (2008).

Tomato has limited shelf life at ambient conditions. Tomato is highly perishable fruit and changes continuously after harvest. Long shelf life is one of the most important characters required after harvest. In order to prevent post harvest losses (Zhu, 2001; Munns, 2003). This study identifies some tomato genotype that has long shelf life. "Dandino, Roma and UTC" are among the cultivars with long shelf life. However, genotypes are identified with short shelf life (Dan gainakawa, Ganwon Falke) among others. Roma cultivar is being reported to have a very long shelf life in India, Italy and United State of America (Wang *et al.*, 2019). Short shelf life is among the factors that contribute to the post harvest loss of tomato in Nigeria. These losses and lack of inadequate storage facilities resulted in tomato crises almost every year (Ja'afar *et al.*, 2019)

CONCLUSION

In conclusion, the research identified the variations and distinctiveness of tomato genotypes grown in Sokoto agro-climatic zone of Nigeria. Tomato landraces and accessions used for tomato production in the area were considered for the research. Different

Munns, R. and James, R .A. (2003). Screening methods for salinity tolerance: a case study with tetraploid wheat. *Plant Soil*, 253, 201–218.

growth pattern, leaf type and shapes, fruit type and weight of fruit at harvest were evaluated. The study identified some genotypes with long shelf life, this could be used as a tool in cultivating tomato with high resilience of storage. However, some genotypes were found to have short shelf life which could be avoided to prevent post harvest loss.

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REFERENCE

- Allen, A. (2008). A passion for tomatoes. *Smithsonian magazine*; Available:<http://www.smithsonianmag.com/science-nature/a-passion-for-tomatoes-947254>.
- AVRDC, (1990). Vegetable production training manual. Asian Vegetable Research and Development Centre, Shanhua, Tainan: 447p.
- Bair, J. and Peters, E.D. (2006). Global commodity chains and endogenous growth: Export dynamism and development in Mexico and Honduras. *World Development*, 34(2), 203-221.
- IPGRI, (2005). Crop parameters. AquaCrop Annex 1 Version 4.0.
- IPGRI, (2015). Plant Genome Databases. SolGenes (for tomato) was developed by Cornell University with funding from the Plant Genome Project of the USDA. The URL for access to this and other plant databases via the World Wide Web is <http://probe.nalusda.gov:8300>.
- Ja'afar, U. and Aliero, A.A. (2015). A Study On The Vegetative And Osmolyte Accumulation of *Capsicum frutescens* L. Under Zinc Stress. *International Journal of Scientific Research and Engineering Studies (IJSRES)*, 2 (8), 23-27.
- Ja'afar, U., Aliero A.A., Shehu, K, Abubakar, L. (2001). A Study on Effects of Salinity on Growth and Yield of Tomato Genotype (*Solanum lycopersicum*). *Sustainable Food Production* ISSN: 2624-876X, Vol. 3, pp 16-24doi:10.18052/www.scipress.com/SFP.3.16
- Van Hintum, J.L. (1993). A computer compatible system for scoring heterogeneous populations. *Genetic Resources and Crop Evolution*, 40, 133-136.

- Wallace, T. (2013). Rural Development through Irrigation: Studies in town on the Kano River Project. CSER, ABU, Zaria, Nigeria.
- Wang, Z., Weber, J.L., Zhong, G., and Tanksley, S.D. (2019). Survey of plant short tandem DNA repeats. *Theoretical and Applied Genetics*, 88, 1–6.
- Zhu, J.K. (2001). Plant salt tolerance. *Trends in Plant Science*, 6, 66-71.