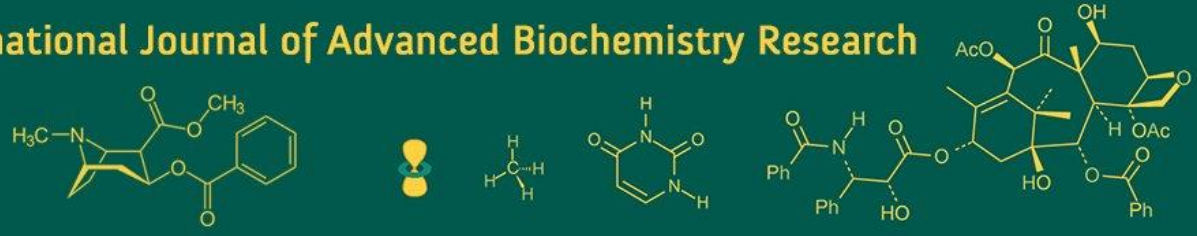
International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; SP-9(12): 1628-1634
www.biochemjournal.com
Received: 22-10-2025
Accepted: 25-11-2025

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Evaluation of germplasm of tomato (*Solanum lycopersicum* L.) for qualitative traits

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DOI: https://www.doi.org/10.33545/26174693.2025.v9.i12Ss.6936

Abstract
The goal of this investigation was to evaluate twelve qualitative traits in forty tomato (*Solanum lycopersicum* L.) germplasm. The forty tomato accessions were evaluated in randomized complete block design with three replication at PG student research farm, College of Horticulture, Rajendranagar, Hyderabad during *Kharif*, 2017. The qualitative traits studied were leaf colour, leaf pubescence, leaf/foliage cover, petiole pubescence, stem type, stem thickness, stem pigmentation, stem pubescence, flower size, flower colour, fruit size, fruit shape. The results showed that there were significant differences in evaluated parameters among cultivars. Finally, the observed variations between the studied genotypes could be used by the tomato breeders in different hybridization programs for the crop improvement.

Keywords: Qualitative traits, tomato germplasm, evaluation

Introduction
Tomato is one of the most important crops widely grown in tropical and temperate regions of the world. Tomato have three different types of growth habits namely; determinate, indeterminate and semi determinate. Tomato has multipurpose uses in fresh as well as processed food industries and its production has increased in the world. It is protective complementary food and dietary vegetable crop. Tomato is also a good source of polyphenolic compounds, such as flavonoids and hydroxycinnamic acids (Bugianesi *et al.*, 2004) [3]. Yield components and morphological traits have been widely used in the evaluation of tomato crops. Identification of indeterminate type tomato plant having higher yield, quality, desirable shape, size and colour is necessary to meet up growing demand of consumers. Qualitative characteristics are the strongest determinants of the agronomic value and taxonomic classification of plants (Bernousi *et al.*, 2011) [2]. The pattern of inheritance for qualitative characters is typically monogenetic, which means each character is only influenced by a single gene. Therefore, the current study was conducted to know about the qualitative traits of tomato germplasm and to select the most promising tomato accessions for future breeding programs.

Materials and Methods
The data on qualitative characters were recorded as per minimal descriptors of NBPGR (Srivastava *et al.*, 2001) [9]. Qualitative data on 12 traits were recorded in each genotype and the details of trait, classification and stage of scoring are presented in Table 1.

Results and Discussions
Forty genotypes of tomato germplasm under present investigation were characterized based on 12 qualitative traits presented in Table 2. Leaf colour showed that twelve genotypes recorded green leaf colour, twenty five genotypes exhibited dark green leaf colour and three genotypes showed light green leaf colour. Leaf pubescence revealed that twenty six genotypes exhibited sparse leaf pubescence, six genotypes showed dense leaf pubescence, four genotypes reported absence, four genotypes are in medium leaf pubescence. Leaf/foliage cover recorded that the twenty five genotypes exhibited good foliage cover, ten genotypes reported moderate foliage cover, one genotype is in dense foliage cover and four

genotypes are in excellent foliage cover. Petiole pubescence showed that thirteen genotypes recorded dense petiole pubescence, eighteen genotypes reported medium petiole pubescence and nine genotypes showed sparse petiole pubescence. Stem type revealed that all the forty genotypes showed round stem type. Stem thickness observed that twenty genotypes exhibited thick stem, nineteen genotypes reported medium stem thickness, one genotype is in thin stem thickness. Stem pigmentation revealed that all the forty genotypes showed green pigmentation on the stem. Stem pubescence showed that four genotypes recorded sparse stem pubescence, nineteen genotypes reported dense stem pubescence and seventeen genotypes observed medium stem pubescence. Flower size revealed that thirty five genotypes exhibited large flower size, five genotypes reported that they are in medium flower size. Flower colour reported that the thirty genotypes exhibited deep yellow flower colour, ten genotypes showed light yellow flower colour. Fruit size showed that three genotypes recorded very large fruit size, nineteen genotypes reported large fruit size, eleven genotypes showed medium large fruit size and seven genotypes are in medium fruit size. Fruit shape showed that eleven genotypes recorded flat round fruit shape, eight are in round, seven in oval, seven in slightly flattened, four in plum shaped and three genotypes are in heart shaped. Similar findings were also observed earlier by Grandillo *et al.*, (1999) [4] and Anuradha *et al.*, 2018 [1] in tomato, Rambabu *et al.*, 2017 [7] and Pidigam *et al.*, 2019 [6] in yardlong bean, Jyothireddy *et al.*, 2018 in dolichos bean and Saidaiah *et al.*, 2021 in oriental cooking melon. . They also reported significant variation among tomato accessions for qualitative traits.

Table 1: Classification and stage of scoring of 12 qualitative traits in tomato

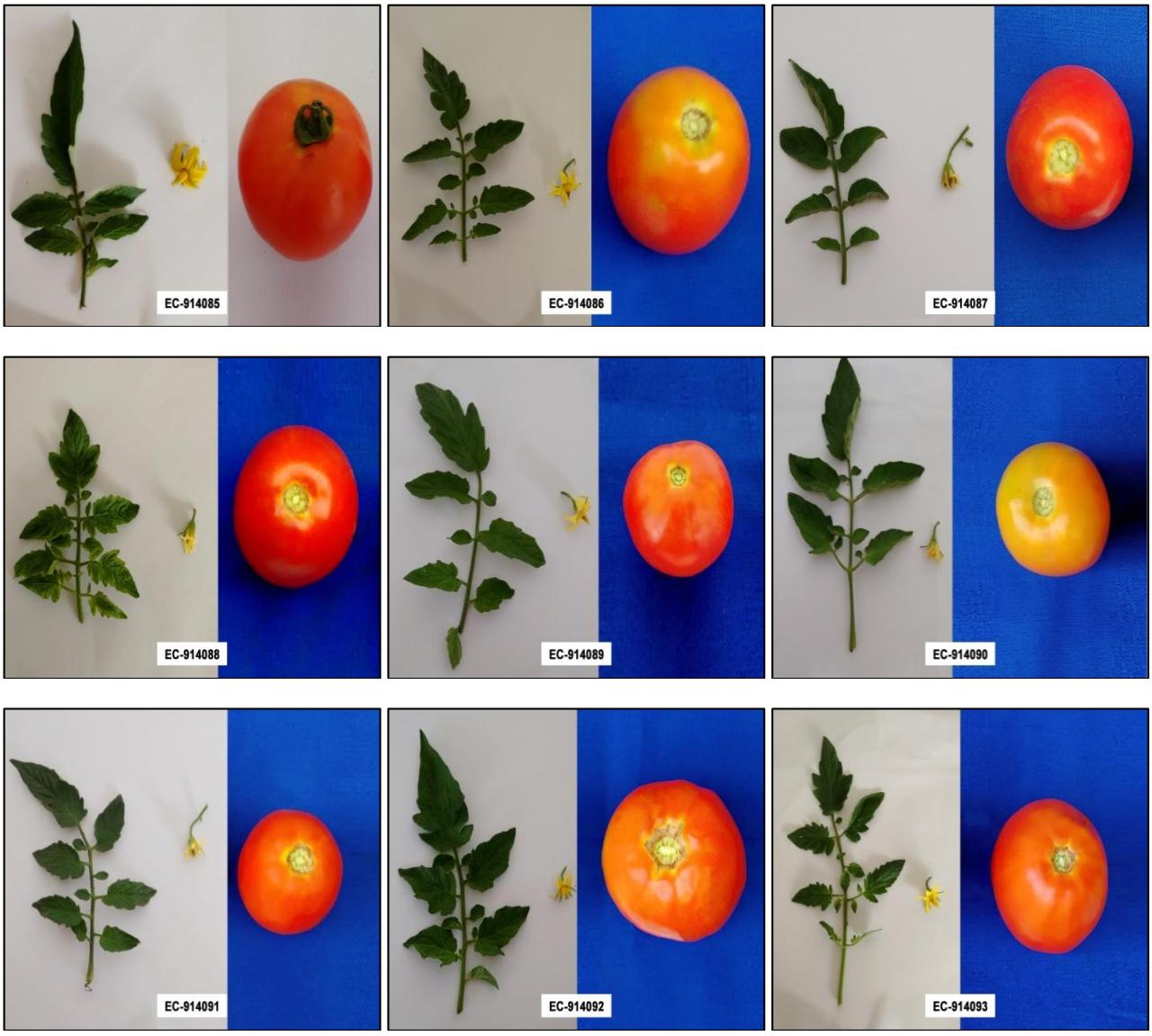
S. No.	Qualitative trait	Classification	Stage of scoring
1	Leaf colour	Light green Green Dark green	At full foliage stage
2	Leaf pubescence	Absent Sparse Medium Dense	At full foliage stage
3	Leaf/foliage cover	Moderate Good Excellent	At full foliage stage
4	Petiole pubescence	Sparse Medium Dense	At full foliage stage
5	Stem type	Round	At full foliage stage
6	Stem thickness	Thin Medium Thick	At full foliage stage
7	Stem pigmentation	Green	At full foliage stage
8	Stem pubescence	Sparse Medium Dense	At full foliage stage
9	Flower size	Medium Large	At full blossom stage
10	Flower colour	Light yellow/cream Deep yellow	At full blossom stage
11	Fruit size	Medium (>30-80 g) Medium larg e(>80-100 g) Large(>100-175 g) Very large(>175 g)	At near maturity stage
12	Fruit shape	Flat round Slightly flattened Round Oval Heart shaped Pyriform Plum shaped	At near maturity stage

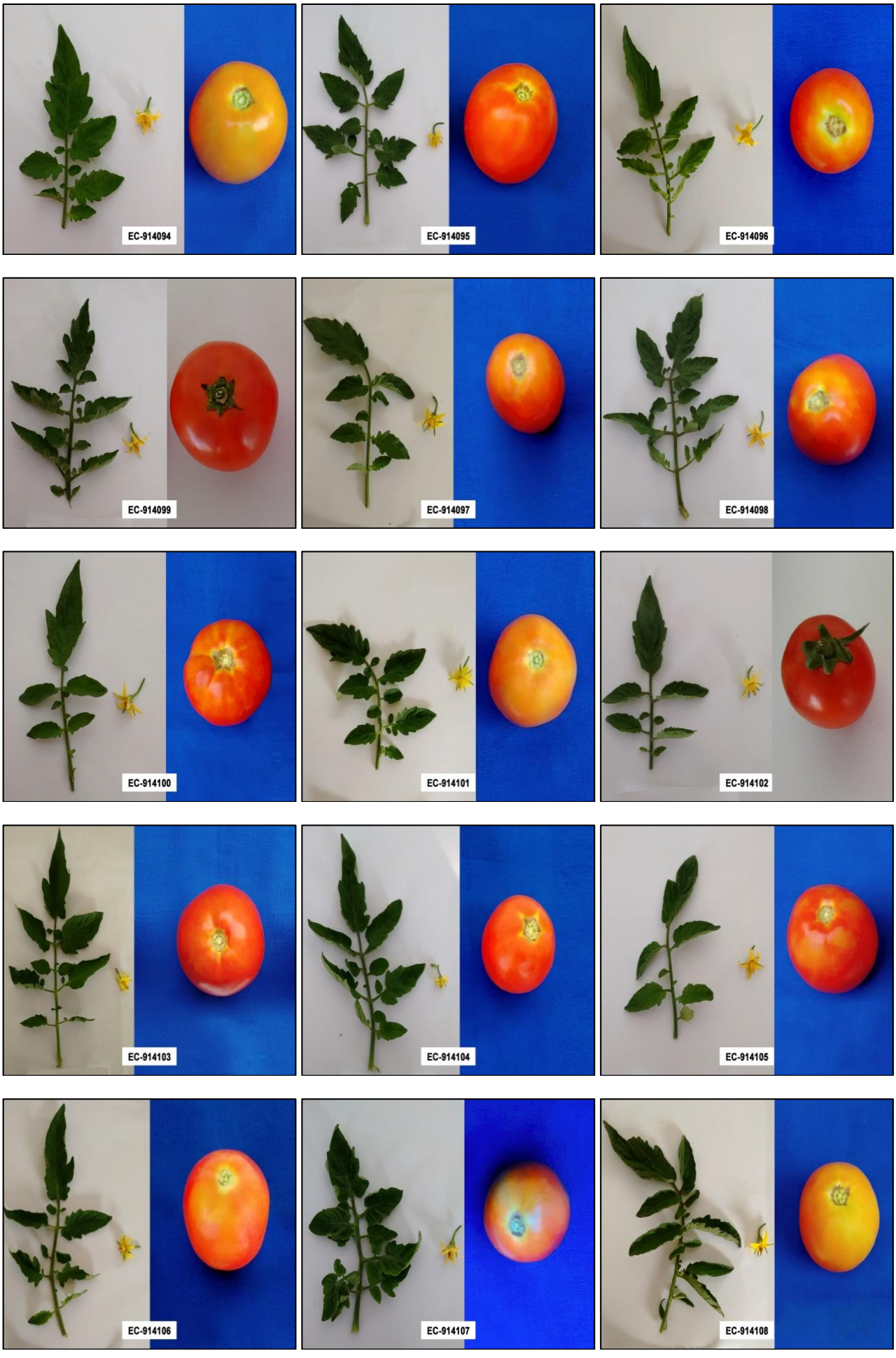
Table 2: Qualitative traits of forty genotypes of tomato

S. No.	Genotypes	Leaf colour	Leaf pubescence	Leaf/foliage cover	Petiole pubescence	Stem type	Stem thickness
1	EC-914085	Green	Sparse	Excellent	Medium	Round	Thick
2	EC-914086	Dark green	Sparse	Good	Dense	Round	Thick
3	EC-914087	Dark green	Absent	Good	Medium	Round	Thick
4	EC-914088	Green	Absent	Moderate	Medium	Round	Medium
5	EC-914089	Green	Medium	Good	Dense	Round	Medium
6	EC-914090	Dark green	Medium	Good	Dense	Round	Thick
7	EC-914091	Dark green	Sparse	Good	Medium	Round	Thick
8	EC-914092	Dark green	Dense	Moderate	Sparse	Round	Thick
9	EC-914093	Green	Sparse	Good	Medium	Round	Medium
10	EC-914094	Light green	Sparse	Excellent	Sparse	Round	Thick
11	EC-914095	Green	Sparse	Moderate	Sparse	Round	Medium
12	EC-914096	Dark green	Sparse	Moderate	Dense	Round	Medium
13	EC-914097	Dark green	Sparse	Moderate	Sparse	Round	Medium
14	EC-914098	Green	Absent	Good	Medium	Round	Medium
15	EC-914099	Green	Sparse	Moderate	Dense	Round	Medium
16	EC-914100	Dark green	Sparse	Good	Medium	Round	Medium
17	EC-914101	Green	Sparse	Good	Dense	Round	Thick
18	EC-914102	Dark green	Sparse	Good	Medium	Round	Thick
19	EC-914103	Green	Sparse	Moderate	Medium	Round	Thick
20	EC-914104	Dark green	Sparse	Good	Dense	Round	Thick
21	EC-914105	Green	Absent	Good	Medium	Round	Thick
22	EC-914106	Light green	Dense	Good	Dense	Round	Medium
23	EC-914107	Light green	Sparse	Good	Medium	Round	Medium
24	EC-914108	Dark green	Sparse	Good	Dense	Round	Thick
25	EC-914109	Green	Sparse	Good	Medium	Round	Medium
26	EC-914110	Dark green	Sparse	Good	Medium	Round	Medium
27	EC-914111	Dark green	Sparse	Good	Medium	Round	Thick
28	EC-914112	Dark green	Dense	Good	Medium	Round	Medium
29	EC-914113	Dark green	Dense	Good	Dense	Round	Medium
30	EC-914114	Dark green	Sparse	Good	Sparse	Round	Thick
31	EC-914115	Green	Dense	Good	Medium	Round	Medium
32	Pusa Ruby©	Dark green	Dense	Dense	Dense	Round	Medium
33	AVTO-1219	Dark green	Sparse	Moderate	Sparse	Round	Thin
34	AVTO-1314	Dark green	Sparse	Moderate	Medium	Round	Medium
35	LA-3667	Dark green	Sparse	Moderate	Sparse	Round	Thick
36	Arka Vikas©	Dark green	Sparse	Good	Sparse	Round	Thick
37	Arka Meghali©	Dark green	Sparse	Good	Dense	Round	Thick
38	Arka Alok©	Dark green	Medium	Excellent	Dense	Round	Thick
39	PKM-1©	Dark green	Sparse	Excellent	Sparse	Round	Thick
40	Marutham©	Dark green	Medium	Good	Medium	Round	Medium

S. No.	Genotypes	Stem pigmentation	Stem pubescence	Flower size	Flower colour	Fruit size	Fruit shape
1	EC-914085	Green	Sparse	Large	Deep yellow	Medium large	Heart shaped
2	EC-914086	Green	Dense	Large	Deep yellow	Medium large	Oval
3	EC-914087	Green	Dense	Large	Deep yellow	Large	Flat round
4	EC-914088	Green	Medium	Large	Light yellow	Medium large	Round
5	EC-914089	Green	Dense	Large	Deep yellow	Medium large	Round
6	EC-914090	Green	Dense	Large	Deep yellow	Very large	Flat round
7	EC-914091	Green	Dense	Large	Deep yellow	Large	Slightly flattened
8	EC-914092	Green	Medium	Medium	Light yellow	Very large	Flat round
9	EC-914093	Green	Medium	Large	Deep yellow	Very large	Flat round
10	EC-914094	Green	Sparse	Large	Deep yellow	Medium large	Round
11	EC-914095	Green	Medium	Large	Light yellow	Large	Oval
12	EC-914096	Green	Medium	Large	Light yellow	Medium large	Round
13	EC-914097	Green	Medium	Large	Deep yellow	Medium large	Slightly flattened
14	EC-914098	Green	Sparse	Large	Light yellow	Large	Slightly flattened
15	EC-914099	Green	Dense	Large	Deep yellow	Large	Plum shaped
16	EC-914100	Green	Dense	Large	Deep yellow	Large	Heart shaped
17	EC-914101	Green	Dense	Large	Light yellow	Large	Flat round
18	EC-914102	Green	Medium	Large	Deep yellow	Large	Plum shaped
19	EC-914103	Green	Medium	Large	Deep yellow	Large	Flat round
20	EC-914104	Green	Medium	Medium	Deep yellow	Large	Round

S. No.	Genotypes	Stem pigmentation	Stem pubescence	Flower size	Flower colour	Fruit size	Fruit shape
21	EC-914105	Green	Medium	Large	Deep yellow	Large	Oval
22	EC-914106	Green	Dense	Large	Deep yellow	Large	Flat round
23	EC-914107	Green	Sparse	Medium	Deep yellow	Large	Slightly flattened
24	EC-914108	Green	Medium	Large	Deep yellow	Medium large	Round
25	EC-914109	Green	Dense	Large	Deep yellow	Medium large	Flat round
26	EC-914110	Green	Medium	Large	Deep yellow	Large	Plum shaped
27	EC-914111	Green	Dense	Large	Deep yellow	Large	Flat round
28	EC-914112	Green	Dense	Large	Deep yellow	Large	Slightly flattened
29	EC-914113	Green	Dense	Large	Deep yellow	Medium large	Oval
30	EC-914114	Green	Dense	Large	Deep yellow	Large	Flat round
31	EC-914115	Green	Medium	Large	Deep yellow	Large	Plum shaped
32	Pusa Ruby©	Green	Dense	Large	Deep yellow	Medium	Slightly flattened
33	AVTO-1219	Green	Medium	Large	Deep yellow	Medium	Oval
34	AVTO-1314	Green	Dense	Large	Deep yellow	Medium	Oval
35	LA-3667	Green	Medium	Large	Deep yellow	Large	Heart shaped
36	Arka Vikas©	Green	Medium	Large	Deep yellow	Medium	Flat round
37	Arka Meghali©	Green	Dense	Large	Light yellow	Medium	Round
38	Arka Alok©	Green	Dense	Large	Light yellow	Medium	Oval
39	PKM-1©	Green	Medium	Medium	Light yellow	Medium	Slightly flattened
40	Marutham©	Green	Dense	Medium	Light yellow	Medium large	Round

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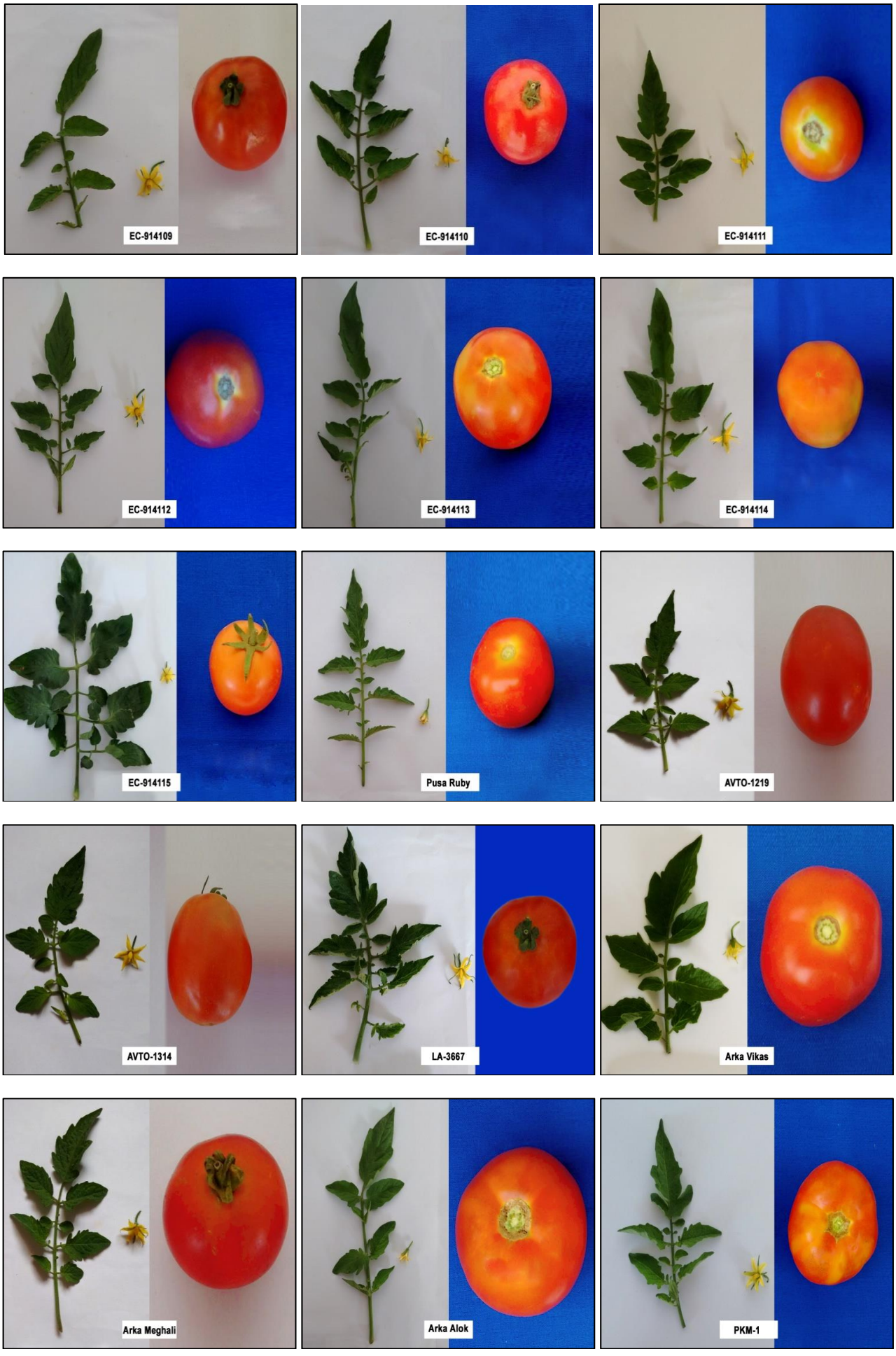
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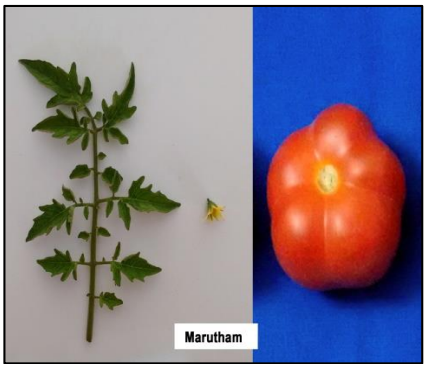

Plate 1: Qualitative traits of forty genotypes of tomato

It is concluded that the germplasm investigated in this study possess characters that could be of interest to plant breeders. They are highly marketable because of the characteristics of their fruits portraying a possible linkage between the fruit and vegetable industry and future research efforts on these germplasms. This requires attention to enhance future utilization. The need for conservation of these resources and knowledge to complement and balance utilization is crucial. The characteristics of the flowers and fruit of the tomato cultivars have been highlighted in this study as key descriptors of tomato.

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