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Screening of tomato (*Solanum lycopersicum* L.) Germplasm for growth, yield, resistance against buckeye rot and alternaria blight severity under mid-hills conditions of Himachal Pradesh

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Abstract

Thirty five genotypes of tomato including one check cultivar Solan Lalima were evaluated for various important horticultural traits in a RCBD with three replications during *Kharif*, 2013. The genotypes EC-620383, EC-620397, EC-620410 and BT-1 took minimum days (29.67 days) to reach 50% flowering. Genotype BT-10 recorded maximum number of fruits per plant (59.23), whereas, JTS-1-3 produced the biggest sized fruits of 86.86 g. Maximum fruit yield per plant was recorded in JTS-10-1 (2.45 kg). BT-10 observed maximum plant height (211.63 cm) and next best genotypes were EC-37239 (201.77 cm) and JTS-1-1 (188.12 cm). The genotypes JTS-10-3 (8.53%) and JTS-10-2 (9.70%) were found moderately resistant to buckeye rot incidence. Least *Alternaria* blight severity was recorded in BT-10 (13.56%) followed by JTS-10-1 (14.35 %) and Yalabingo (14.47 %). Based on the performance the genotypes JTS-10-1, JTS-10-2, Yalabingo, EC-37239, EC-267727, LE-79-5, BT-10, EC-191535-3 and JTS-1-1 were found superior than check cultivar Solan Lalima. Therefore these genotypes can be used as such or can further be subjected to selection or heterosis breeding to get the desirable variety of tomato for mid-hills of Himachal Pradesh.

Keywords: tomato, *Solanum lycopersicum* L., Buckeye rot, *Alternaria* blight

Introduction

Tomato (*Solanum lycopersicum* L.) is one of the important vegetables grown throughout the world and occupying prime position among processed vegetable. It is one of the most popular vegetable in India grown in tropical, subtropical and mild cold climate regions on an area of 797 thousand ha with an annual production of 20708 MT (Anonymous 2016-17) [1]. Varsality of tomato in fresh and processed form plays major role in its rapid and wide spread adoption as an important food commodity. Its fruits are good source of Vitamin A and C as well as contain antioxidant such as lycopene which prevents cancer (Bhutani and Kallo, 1983) [4]. Tomato is most remunerative cash crop of mid hills of Himachal Pradesh being grown as an off season vegetable for fresh market and supply the produce to the plains of northern India. The annual production of tomato in Himachal Pradesh is 458 thousand MT from an area of 11.03 thousand hectares (Anonymous 2015) [2]. It is being grown for off season produce, brings lucrative returns to the hill farmers.

The cropping period of tomato in Himachal Pradesh coincides with monsoon rains which invite many diseases, insect pests and weeds, hence, poses serious problems in its cultivation. Longer harvesting period and off season production of tomato make this crop more suitable for cultivation in mid-hills conditions. The productivity of tomato grown in the region is much less than its potential yields due to the non availability high yielding disease and insect pest resistant cultivar for growing in hilly areas. Realizing this, there is a need for continuous crop improvement in tomato which can be achieved by isolating superior breeding lines/varieties having desirable horticultural traits. Therefore the present investigation was carried out on 35 diverse genotypes of tomato to study their performance and screening against buckeye rot and *Alternaria* blight severity.

Materials and Methods

The present investigation was carried out at the experimental farm of the Department of Vegetable Science, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh during *Kharif* season of 2013. Thirty five genotypes of tomato including one check Solan Lalima were laid out in a Randomized Complete Block Design with three

replications. The genotypes along with their sources are presented in Table 1. The plot size was 2.0 m x 1.8 m with 90 cm and 30 cm spacing between rows and plants respectively. The standard cultural practices recommended in the Package of Practices of Vegetable Crops were followed to produce a healthy crop stand (Anonymous, 2013) [3].

Data were recorded on ten randomly selected plants from each genotype and each replication and their means were worked out for statistical analysis. The mean values of data were subjected to analysis of variance as described by Gomez and Gomez (1983) [7]. The observations were recorded on days to 50% flowering, number of fruits per cluster, number of fruits per plant, average fruit weight (g), fruit yield per plant (kg), fruit yield per plot (kg), fruit yield per hectare (q), fruit shape index, number of locules per fruit, pericarp thickness (mm), plant height (cm), harvest duration (days), internodal distance (cm), days to marketable maturity, total soluble solids (° Brix), ascorbic acid content (mg/100g), buckeye rot incidence (%) and alternaria blight severity (%). The incidence of buckeye rot under natural epiphytotic conditions in each genotype was recorded periodically by using the following formula:

$$(\%) \text{ Disease incidence} = \frac{\text{Number of diseased fruits per plant}}{\text{Total number of fruits per plant}} \times 100$$

The disease reaction was categorized as per the scale given by Dodan, 1995 [6].

Scale/grade	Disease incidence (%)	Reaction
1.	Nil	Resistant
2.	0.1-10.0	Moderately Resistant (MR)
3.	10.1-25.0	Moderately Susceptible (MS)
4.	25.1-45.0	Susceptible (S)
5.	45.1 and above	Highly Susceptible (HS)

The Alternaria blight severity under natural epiphytotic conditions was assessed as per the scale given by Dobhal and Monga (1991) [5].

Grade	Leaf Area infected (%)
0	Nil
1	1.0-15.0
2	16.0-30.0
3	31.0-50.0
4	51.0-75.0
5	More than 75

The per cent severity index was calculated by the formula given by Singh (1988) [12] as given below:

$$(\%) \text{ Severity index} = \frac{\text{Sum of all the diseases ratings}}{\text{Total No. of leaflets in all the grades} \times \text{Maximum diseases grade}} \times 100$$

Disease rating = Grade × leaflets in a grade

The statistical analysis was carried out for each observed character under study using MS-Excel and SPAR 1.0 packages. The mean values of data were subjected to analysis of variance as described by Gomez and Gomez (1983) [7] for Randomized Complete Block Design.

Results and Discussion

The analysis of variance indicated highly significant differences among the genotypes for all the traits studied (Table 2), which revealed the existence of sufficient variability in the germplasm. The mean performance of all the genotypes for various horticultural traits (Table 3) is described as follows:

Table 1: List of tomato genotypes studied along with their sources

Sr. No.	Genotype	Source
1	EC-1749/3	NBPGR, New Delhi
2	EC-8910-155	NBPGR, New Delhi
3	EC-37239	NBPGR, New Delhi
4	EC-191531	NBPGR, New Delhi
5	EC-191535-3	NBPGR, New Delhi
6	EC-267727	NBPGR, New Delhi
7	EC-535580	NBPGR, New Delhi
8	EC-620370	NBPGR, New Delhi
9	EC-620374	NBPGR, New Delhi
10	EC-620375	NBPGR, New Delhi
11	EC-620378	NBPGR, New Delhi
12	EC-620383	NBPGR, New Delhi
13	EC-620396	NBPGR, New Delhi
14	EC-620397	NBPGR, New Delhi
15	EC-620398	NBPGR, New Delhi
16	EC-620400	NBPGR, New Delhi
17	EC-620402	NBPGR, New Delhi
18	EC-620407	NBPGR, New Delhi
19	EC-620410	NBPGR, New Delhi
20	EC-620424	NBPGR, New Delhi
21	EC-620434	NBPGR, New Delhi
22	EC-620435	NBPGR, New Delhi
23	JTS-1-1	RHRS, Jachh
24	JTS-1-3	RHRS, Jachh
25	JTS-7-6	RHRS, Jachh
26	JTS-10-1	RHRS, Jachh
27	JTS-10-2	UHF, Nauni, Solan
28	JTS-10-3	UHF, Nauni, Solan
29	JTS-10-10	RHRS, Jachh
30	LE-79-5	RHRS, Bajaura
31	BT-1	UHF, Nauni, Solan
32	BT-10	UHF, Nauni, Solan
33	Yalabingo	UHF, Nauni, Solan
34	Arka Keshav	IIHR, Bangalore
35	Solan Lalima (Check Variety)	UHF, Nauni, Solan

Table 2: Analysis of variance for various horticultural traits in tomato

Characters/Source	df	Mean Sum of Squares									
		Days to 50% flowering	Number of fruits per cluster	Number of fruits per plant	Average fruit weight (g)	Fruit yield per plant (kg)	Fruit yield per plot (kg)	Fruit yield (q/ha)	Fruit shape index	Number of locules per fruit	Pericarp thickness (mm)
Replication	2	3.438	0.074	88.986*	44.605*	0.188*	26.128*	12902.650*	0.021*	0.957*	1.362*
Genotype	34	12.688*	2.629*	455.735*	629.406*	1.410*	207.649*	102542.700*	0.045*	0.808*	1.992*
Error	68	1.987	0.185	10.855	10.615	0.020	3.436	1697.037	0.002	0.086	0.148
Total	104	18.113	2.888	555.576	684.626	1.618	237.213	117142.400	0.068	1.851	3.502

*Significant at 5% level of significance

Table 3: Mean Performance of tomato genotypes for different horticultural traits

Genotypes	Days to 50% flowering	Number of fruits per cluster	Number of fruits per plant	Average fruit weight (g)	Fruit shape index	Number of locules per fruit	Pericarp thickness (mm)	Plant height (cm)	Harvest duration (days)	Internodal distance (cm)	Days to marketable maturity	Total soluble solids (°B)	Ascorbic acid content (mg/100g)	Fruit yield per plant (kg)	Fruit yield per plot (kg)	Fruit yield per hectare (q)
EC-1749/3	33.33	5.47	24.07	76.28	0.80	3.25	6.85	131.20	33.00	8.73	71.33	4.37	26.63	1.81	21.64	480.89
EC-8910-155	30.67	5.07	30.07	57.17	0.85	2.78	3.40	113.23	34.00	10.24	68.67	3.87	20.43	1.67	20.00	444.44
EC-37239	33.67	4.40	32.63	70.33	0.79	3.58	5.38	201.77	39.00	11.21	71.67	4.07	20.23	2.26	27.12	602.67
EC-191531	32.00	5.73	29.27	62.71	0.92	3.75	5.80	143.97	34.00	9.55	73.00	3.43	20.20	1.81	21.76	483.56
EC-191535-3	33.33	6.53	39.33	54.81	0.81	3.50	6.23	146.60	37.33	8.11	71.33	3.70	19.83	2.12	25.48	566.22
EC-267727	30.67	5.07	40.33	56.38	1.05	4.00	4.80	156.21	38.67	10.41	68.67	4.30	18.87	2.25	26.96	599.11
EC-535580	33.67	6.07	44.40	11.23	0.78	3.20	3.42	123.87	37.00	8.48	71.33	3.43	22.30	0.47	5.68	126.22
EC-620370	34.67	3.47	8.67	58.17	1.07	3.60	6.36	58.97	19.00	12.63	75.67	3.47	31.27	0.48	5.84	129.78
EC-620374	31.67	3.67	13.60	77.77	1.20	2.30	6.62	73.77	29.00	6.33	69.67	3.73	16.60	1.03	12.36	274.67
EC-620375	30.33	3.47	12.85	78.81	1.11	2.69	6.35	73.40	28.67	8.89	72.00	3.93	24.73	0.99	11.8	262.22
EC-620378	33.67	3.80	16.27	37.33	1.17	2.45	6.05	59.88	31.00	8.48	74.33	3.90	29.80	0.58	7.00	155.56
EC-620383	29.67	4.53	22.13	47.30	0.88	2.97	5.59	95.23	32.33	9.07	67.67	3.77	19.33	1.01	12.16	270.22
EC-620396	30.67	4.13	17.33	53.55	1.13	3.25	5.11	86.01	31.33	8.86	73.67	3.83	33.03	0.90	10.76	239.11
EC-620397	29.67	4.13	20.87	55.66	1.06	3.22	6.40	70.33	32.00	8.03	67.67	3.60	16.47	1.13	13.56	301.33
EC-620398	31.33	4.20	15.67	43.66	1.04	3.58	6.20	74.03	30.00	10.61	69.33	3.73	20.77	0.66	7.84	174.22
EC-620400	30.33	4.67	17.53	68.14	0.94	3.47	4.92	109.22	31.33	9.04	70.00	3.73	16.77	1.17	14.04	312.00
EC-620402	37.33	3.27	7.83	46.00	1.07	3.67	6.89	69.97	18.00	10.28	80.33	3.57	24.93	0.34	4.04	89.78
EC-620407	30.33	3.67	9.60	50.13	0.97	4.67	6.64	61.37	20.33	8.15	68.33	2.77	13.53	0.45	5.44	120.89
EC-620410	29.67	4.53	20.10	40.77	1.07	2.80	5.20	93.48	31.33	9.25	67.67	4.10	21.03	0.80	6.28	139.63
EC-620424	31.00	4.27	11.47	49.29	1.03	3.72	6.19	70.57	27.33	10.89	69.00	3.33	10.13	0.54	6.44	143.11
EC-620434	31.67	5.07	16.87	64.11	0.91	3.67	4.97	83.63	31.00	10.87	69.67	3.43	28.33	1.05	12.64	280.89
EC-620435	31.67	5.27	11.80	62.98	1.10	2.53	5.07	107.50	27.67	11.84	72.67	3.73	18.57	0.73	8.76	194.67
JTS-1-1	32.67	5.47	32.07	63.83	0.82	3.5	6.24	188.12	35.33	13.09	70.67	4.43	22.33	2.02	24.24	538.67
JTS-1-3	33.33	5.13	14.20	86.86	1.11	3.58	5.57	107.23	30.33	10.70	76.33	4.03	19.47	1.21	14.48	321.78
JTS-7-6	31.67	4.53	12.53	59.24	1.01	3.00	6.27	76.20	28.33	8.79	72.67	4.10	18.17	0.71	8.56	190.22
JTS-10-1	36.67	6.13	37.13	67.89	0.95	2.75	5.84	145.93	36.33	10.36	74.67	4.20	23.23	2.45	29.44	654.22
JTS-10-2	35.33	5.73	34.73	70.47	0.94	2.89	7.25	153.70	36.67	10.86	75.33	4.33	20.63	2.42	28.96	643.56
JTS-10-3	32.33	4.80	30.47	48.31	0.98	4.03	5.2	145.70	34.67	8.72	70.33	3.67	9.90	1.44	17.24	383.11
JTS-10-10	31.67	6.60	36.93	46.56	1.12	2.83	7.42	134.49	37.00	11.47	69.67	3.70	19.57	1.69	20.28	450.67
LE-79-5	30.67	6.27	39.53	57.14	1.06	2.89	5.86	134.67	37.67	10.30	68.67	3.30	26.43	2.24	26.88	597.33
BT-1	29.67	6.13	10.53	55.34	1.22	2.75	6.79	101.30	25.00	11.16	67.67	3.80	20.17	0.56	6.72	149.33
BT-10	30.67	4.13	59.23	36.87	0.86	2.92	5.55	211.63	41.00	11.17	68.67	4.30	33.60	2.15	25.88	575.11
Yalabingo	33.67	5.27	32.57	73.29	0.86	3.53	6.20	175.97	35.67	11.51	71.67	3.47	20.47	2.36	28.32	629.33
Arka Keshav	36.33	4.67	20.07	63.41	1.04	2.75	6.18	141.52	32.00	9.58	79.33	3.87	23.67	1.24	14.88	330.67
Solan Lalima	31.67	6.00	29.73	64.70	0.93	2.75	6.31	154.47	34.33	10.98	73.33	4.00	22.27	1.90	22.76	505.78
Mean	32.21	4.90	24.35	57.59	0.99	3.22	5.94	114.22	31.93	9.96	71.50	3.80	21.53	1.33	15.89	353.17
± SE(d)	1.15	0.35	2.69	2.66	0.04	0.24	0.31	5.57	1.27	1.14	1.20	0.15	1.51	0.12	1.51	33.64
CD _(0.05)	2.30	0.70	5.38	5.32	0.08	0.48	0.63	11.14	2.77	2.27	2.40	0.31	3.01	0.23	3.03	67.27

Days to 50% flowering

The genotypes EC-620383, EC-620397, EC-620410 and BT-1 took minimum days (29.67 days) to reach 50% flowering and it was found statistically at par with sixteen genotypes viz., EC-620375 (30.33 days), EC-620400 (30.33), EC-620407 (30.33 days), EC-8910-155 (30.67 days), EC-267727 (30.67 days), EC-620396 (30.67 days), LE-79-5 (30.67 days), BT-10 (30.67 days), EC-620424 (31.00 days), EC-620398 (31.33 days), EC-620374 (31.67 days), EC-620434 (31.67 days), EC-620435 (31.67 days), JTS-7-6 (31.67 days), JTS-10-10 (31.67 days) and Solan Lalima (31.67 days). Among all the genotypes under study, as many as fourteen genotypes have taken lesser number of days to 50% flowering than the standard check cultivar Solan Lalima (31.67 days).

Number of fruits per cluster

Maximum number of fruits per cluster was observed in JTS-10-10 (6.60) and it was statistically at par with six genotypes viz., EC-191535-3 (6.53), LE-79-5 (6.27), JTS-10-1 (6.13), BT-1 (6.13), EC-535580 (6.07) and Solan Lalima (6.00). Minimum number of fruits per cluster were observed in EC-620402 (3.27) and found statistically at par with five genotypes.

Number of fruits per plant

BT-10 recorded maximum number of fruits per plant (59.23). Minimum number of fruits per plant was observed in EC-

620402 (7.83) and it was statistically at par with seven genotypes. Thirteen genotypes produced more number of fruits per plant than the check cultivar Solan Lalima (29.73).

Average fruit weight (g)

Nine genotypes viz., JTS-1-3 (86.86 g), EC-620375 (78.81 g), EC-620374 (77.77 g), EC-1749/3 (76.28 g), Yalabingo (73.29 g), JTS-10-2 (70.47 g), EC-37239 (70.33 g), EC-620400 (68.14 g) and JTS-10-1 (67.89 g) gave higher fruit weight than the check cultivar Solan Lalima (64.70 g). Maximum average fruit weight was recorded in JTS-1-3 (86.86 g) and minimum was recorded in EC-535580 (11.23 g).

Fruit shape index

Fruit shape index showed significant variation among genotypes. Twenty three genotypes recorded higher index value than the check cultivar Solan Lalima (0.93). Genotype BT-1 depicted maximum index value (1.22) which was statistically at par with EC-620374 (1.20) and EC-620378 (1.17). Minimum index value (0.78) was observed in EC-535580 which was statistically at par with seven genotypes. Eleven genotypes including check cultivar Solan Lalima produced spherical fruits (0.86-0.99). Eighteen genotypes had higher index value than population mean and produced spherical to oval shaped fruits.

On the basis of fruit shape index values, the genotypes have been grouped into three categories as mentioned in Table.

Categories of genotypes on the basis of fruit shape index values

Fruit shape index values	Shapes	Genotypes
1 or more	Oval	EC-267727, EC-620370, EC-620374, EC-620375, EC-620378, EC-620396, EC-620397, EC-620398, EC-620402, EC-620410, EC-620424, EC-620435, JTS-1-3, JTS-7-6, JTS-10-10, LE-79-5, BT-1 and Arka Keshav
0.86-0.99	Spherical	EC-191531, EC-620383, EC-620400, EC-620407, EC-620434, JTS-10-1, JTS-10-2, JTS-10-3, BT-10, Yalabingo and Solan Lalima
0.71-0.86	Flat round	EC-1749/3, EC-8910-155, EC-37239, EC-191535-3, EC-535580 and JTS-1-1

Number of locules per fruit

Minimum number of locules per fruit was observed in EC-620374 (2.30) which was statistically at par with eight genotypes including check cultivar Solan Lalima and maximum locules per fruit was recorded in EC-620407 (4.67). Three genotypes viz., EC-620374 (2.30), EC-620378 (2.45) and EC-620435 (2.53) had lesser number of locules per fruit than the check cultivar Solan Lalima (2.75).

Pericarp thickness (mm)

Significant variation for pericarp thickness was obtained among all the genotypes studied. Maximum pericarp thickness (7.42 mm) was observed in JTS-10-10 which was statistically at par with JTS-10-2 (7.25 mm), EC-620402 (6.89 mm), EC-1749/3 (6.85 mm) and BT-1 (6.79 mm). Ten genotypes had more pericarp thickness than check cultivar Solan Lalima (6.31 mm).

Plant height (cm)

Comparison of genotypes revealed that different genotypes differed significantly for plant height. Maximum plant height was observed in BT-10 (211.63 cm) and it was statistically at par with EC-37239 (201.77 cm). Five genotypes viz., BT-10 (211.63 cm), EC-37239 (201.77 cm), JTS-1-1 (188.12 cm), Yalabingo (175.97 cm) and EC-267727 (156.21 cm) and resulted in more plant height than the check cultivar Solan Lalima (154.47 cm).

Harvest duration (days)

Maximum harvest duration (41.00 days) was recorded in genotype BT-10 which was in statistical proximity with EC-37239 (39.00 days) and EC-267727 (38.67 days). Twelve genotypes had longer harvest duration than check cultivar Solan Lalima (34.33 days).

Internodal Distance (cm)

The genotype EC-620374 recorded lowest internodal length (6.33 cm) and was statistically at par with genotypes EC-620397 (8.03 cm), EC-191535-3 (8.11 cm), EC-620407 (8.15 cm), EC-535580 (8.48 cm) and EC-620378 (8.48 cm). Genotype JTS-1-1 showed highest internodal length (13.09 cm) and it was found statistically at par with eleven genotypes including check cultivar Solan Lalima. Twenty six genotypes produced lower internodal distance than the check cultivar Solan Lalima (10.98 cm).

Days to marketable maturity

Genotypes EC-620383, EC-620397, EC-620410 and BT-1 were earliest (67.67 days) in maturity and were found statistically at par with eleven genotypes. Twenty six genotypes were earlier in maturity than the check cultivar Solan Lalima (73.33 days). Genotype EC-620402 took maximum days to marketable maturity (80.33 days) and found statistically at par with Arka Keshav (79.33 days).

Total soluble solids (°B)

Maximum value for total soluble solids (4.43 °B) was recorded in JTS-1-1 which was statistically at par with genotypes EC-1749/3 (4.37 °B), JTS-10-12 (4.33 °B), EC-267727 (4.30 °B), BT-10 (4.30 °B) and JTS-10-1 (4.20 °B). Ten genotypes recorded maximum value for total soluble solids than the check cultivar Solan Lalima (4.00 °B).

Ascorbic acid content (mg/100g)

The data recorded for ascorbic acid content showed significant differences among the genotypes. Genotype BT-10 had maximum ascorbic acid content (33.60 mg/100g) which was statistically at par with EC-620396 (33.03 mg/100g) and EC-620370 (31.27 mg/100g). Minimum value for this trait was found in JTS-10-3 (9.90 mg/100g) which was at par with EC-620424 (10.13 mg/100g). Thirteen genotypes recorded maximum value for total soluble solids than the check cultivar Solan Lalima (22.27 mg/100g).

Buckeye rot incidence (%)

The field trial study conducted under natural epiphytotic conditions revealed significant differences for the buckeye rot incidence among different tomato genotypes under study (Table 4). The minimum buckeye rot incidence (8.53%) was observed in JTS-10-3 which was statistically at par with JTS-10-2 (9.70%), BT-10 (10.24%), LE-79-5 (10.43%), JTS-10-1 (10.76%) and EC-191535-3 (11.08%). Buckeye rot incidence in JTS-7-6 (52.50 %) was significantly higher than all other genotypes. Twenty three genotypes recorded less incidence of buck eye rot than the check cultivar Solan Lalima (21.10%). On the basis of disease incidence recorded under natural epiphytotic conditions, various genotypes were categorized as moderately susceptible (fourteen genotypes), susceptible (twenty genotypes) and highly susceptible (JTS-7-6).

Alternaria blight severity (%)

Data recorded on Alternaria blight severity under natural epiphytotic conditions revealed significant variation among all the genotypes (Table 4). Minimum Alternaria blight severity was recorded in BT-10 (13.56%) which was statistically at par with genotypes JTS-10-1 (14.35%), Yalabingo (14.47%), JTS-1-1 (14.65%), EC-191535-3 (14.83%), JTS-10-2 (15.47%), EC-267727 (15.70%), JTS-10-3 (15.80%), Arka Keshav (16.20%), JTS-10-10 (16.47%), EC-37239 (16.53%), EC-1749/3 (16.79%) and EC-535580 (23.27%). Seventeen genotypes recorded less Alternaria blight severity than the check cultivar Solan Lalima (20.40%). On the basis of disease severity under natural epiphytotic conditions, various genotypes were categorized into twenty four as moderately resistant (15.01-30.00 %) and eleven as moderately susceptible (30.01-50.00 %) to Alternaria blight severity.

Fruit yield (kg/plant, kg/plot and q/ha)

Maximum fruit yield per plant was recorded in JTS-10-1 (2.45 kg) and it was found statistically at par with genotypes JTS-10-2 (2.42 kg), Yalabingo (2.36 kg), EC-37239 (2.26 kg), EC-267727 (2.25 kg) and LE-79-5 (2.24 kg). Nine genotypes viz., JTS-10-1 (2.45 kg), JTS-10-2 (2.42 kg), Yalabingo (2.36 kg), EC-37239 (2.26 kg), EC-267727 (2.25 kg), LE-79-5 (2.24 kg), BT-10 (2.15 kg), EC-191535-3 (2.12 kg) and JTS-1-1 (2.02 kg) recorded higher yield per plant than the check cultivar Solan Lalima (1.90 kg).

Comparison of data recorded on fruit yield per plot also revealed maximum fruit yield per plot in JTS-10-1 (29.44 kg)

and it was found statistically at par with genotypes JTS-10-2 (28.96 kg), Yalabingo (28.32 kg), EC-37239 (27.12 kg), EC-267727 (26.96 kg) and LE-79-5 (26.88 kg). Minimum fruit yield per plot was recorded in EC-620402 (4.04 kg) and it was statistically at par with seven genotypes.

Similarly, observations on fruit yield per hectare again showed that maximum yield per hectare was recorded by JTS-10-1 (654.22 q/ha) and was statistically at par with JTS-10-2 (643.56 q/ha), Yalabingo (629.33 q/ha), EC-37239 (602.67 q/ha), EC-267727 (599.11 q/ha) and LE-79-5 (597.33 q/ha). Nine genotypes viz., JTS-10-1 (654.22 q/ha), JTS-10-2 (643.56 q/ha), Yalabingo (629.33 q/ha), EC-37239 (602.67 q/ha), EC-267727 (599.11 q/ha), LE-79-5 (597.33 q/ha), BT-10 (575.11 q/ha), EC-191535-3 (566.22 q/ha) and JTS-1-1 (538.67 q/ha) recorded higher fruit yield per hectare than the check cultivar Solan Lalima (505.78 q/ha).

Similar results have been reported by many earlier workers for most of the yield and yield attributing traits in tomato Vidya Bhati (2017) [13], Prajapati et al. (2015) [10], Premalakshmi et al. (2014) [11], Kumar and Srivastava (2013) [9] and Kumar (2006) [8].

Table 4: Mean performances of tomato genotypes for Buckeye rot incidence (%) and Alternaria blight severity (%)

Genotypes	Buckeye rot incidence (%)	Alternaria blight severity (%)
	Mean	Mean
EC-1749/3	12.52(20.54)	16.79(24.10)
EC-8910-155	18.99(25.60)	23.03(28.61)
EC-37239	14.83(22.40)	16.53(23.79)
EC-191531	18.71(25.35)	19.42(26.06)
EC-191535-3	11.08(19.28)	14.83(22.53)
EC-267727	15.24(22.78)	15.70(23.17)
EC-535580	15.06(22.64)	15.74(23.27)
EC-620370	36.04(36.82)	25.24(30.10)
EC-620374	20.53(26.75)	23.20(28.72)
EC-620375	36.33(37.00)	36.22(36.95)
EC-620378	19.29(25.85)	20.37(26.75)
EC-620383	32.90(34.89)	26.42(30.88)
EC-620396	20.90(27.03)	23.83(29.16)
EC-620397	18.53(25.21)	22.25(28.06)
EC-620398	19.86(26.29)	20.46(26.82)
EC-620400	34.70(35.99)	34.72(30.06)
EC-620402	36.24(36.95)	32.14(34.46)
EC-620407	37.81(37.87)	38.62(38.39)
EC-620410	18.70(25.31)	20.02(26.40)
EC-620424	34.10(35.64)	32.61(34.74)
EC-620434	27.91(31.72)	28.33(32.04)
EC-620435	38.06(38.04)	43.75(41.38)
JTS-1-1	13.39(21.30)	14.65(22.32)
JTS-1-3	19.96(26.33)	23.18(28.71)
JTS-7-6	52.50(46.42)	49.58(44.74)
JTS-10-1	10.76(19.02)	14.35(22.19)
JTS-10-2	9.70(18.00)	15.47(22.95)
JTS-10-3	8.53(16.78)	15.80(23.29)
JTS-10-10	16.83(23.95)	16.47(23.75)
LE-79-5	10.43(18.68)	14.30(22.03)
BT-1	37.53(37.70)	40.54(39.52)
BT-10	10.24(18.49)	13.56(21.30)
Yalabingo	13.24(21.06)	14.47(22.11)
Arka Keshav	14.77(22.29)	16.20(23.64)
Solan Lalima	21.10(27.13)	20.40(26.76)
Mean	23.41(27.35)	22.21(28.45)
± SE(d)	1.80	2.31
CD(0.05)	3.60	4.63

Figures in the parenthesis are the arc sine transformed values.

Conclusion

The genotypes JTS-10-1, JTS-10-2, Yalabingo, EC-37239, EC-267727, LE-79-5, BT-10, EC-191535-3 and JTS-1-1 gave highest fruit yield than check cultivar Solan Lalima and also recorded least incidence to buckeye rot and alternaria blight severity therefore these genotypes can be subjected to selection or heterosis breeding to get desirable variety/hybrid of tomato for cultivation under mid-hills conditions of Himachal Pradesh

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