



Study of genetic variability and correlation analysis of quantitative traits in tomato (*Solanum lycopersicum* L.)

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ABSTRACT

The present study was carried out with seventy-eight genotypes of tomato during the *Kharif* 2021 at Vegetable Experimental Field, Sher Kashmir University of Agricultural Science and Technology-Kashmir, Shalimar, Srinagar. The experiment was conducted in Randomized Block Design with three replications. Observations were recorded on eighteen quantitative traits. The results revealed significant variation among genotypes for the characters studied. Among all the genotypes, SK-T-63 showed the highest fruit yield per hectare (977.05q hec⁻¹). Higher phenotypic and genotypic coefficients of variation (PCV and GCV) were observed for fruit yield per hectare, fruit yield per plant and number of fruits per plant. High heritability coupled with high genetic advance as per cent of mean were observed for number of fruits per plant, seed yield per plant, average fruit weight, fruit yield per hectare, fruit yield per plant, pericarp thickness, number of locules and number of pickings. The yield per hectare displayed positive correlation with number of pickings, number of fruits per plant, fruit length, fruit diameter, pericarp thickness, number of locules per fruit, number of primary branches, number of fruits per cluster, plant height, average fruit weight, and fruit yield per plant. The findings suggested that average fruit weight, number of fruits per plant, fruit length, fruit diameter and number of locules per fruit should be considered as important characters for improvement of tomato through selection.

Key words: Correlation, genetic advance, heritability

Tomato (*Solanum lycopersicum* L.) is one of the economically important and widely grown vegetable in *Solanaceae* family because of its high consumer preference, wider adaptability, high yielding potential and suitability for variety of uses in fresh as well as processed food industries. All species of tomato are native to Western South America. The total global area under tomato is 50,30545 hectares with the global production of 18,0766329 tonnes (Anonymous, 2020a). In India it is grown on an area of 812 thousand hectares with a production of 20,573 thousand metric tonnes (Anonymous, 2020b). In J&K, it is grown on an area of 2.28 thousand hectares with a production of 52.96 thousand metric tonnes (Anonymous, 2018).

The level of genetic variability in yield attributing traits determines crop improvement, therefore assessing and utilising genetic variability in the desired direction is critical in every yield improvement programme. The extent of genetic variability in a specific breeding population depends on the genotypes included in it and its selection history. In this regard, it is necessary to survey the available useful variability and nature of association among the various plant characters. It is necessary to partition the observed phenotypic variability into its heritable and non-heritable components with parameters like phenotypic and genotypic coefficient of variation, heritability and genetic advance. Efficiency of selection can be determined by using genetic advance. For any effective selection programme, it would be desirable to consider the relative magnitude of association of various characters with yield. Correlation coefficient analysis measures the mutual relationship

between various plant characters and determines the component characters on which selection can be based for improvement in yield. On the basis of these strategies, present investigation was undertaken to study the variability, heritability, genetic advance and correlation analysis in eighty genotypes of tomato.

MATERIALS AND METHODS

The present experiment was conducted with seventy eight diverse genotypes of tomato collected from diverse agroclimatic regions of India in randomized block design with three replications during the *Kharif* 2021 at Vegetable Experimental Field, Sher Kashmir University of Agricultural Science and Technology-Kashmir, Shalimar, Srinagar. A spacing of 60 cm × 45 cm was adopted and all the standard practices and plant protection measures were timely adopted to raise the crop successfully. Observations were recorded on five randomly selected competitive plants per replication for each entry on eighteen quantitative traits viz., number of days to 1st flowering, number of days to 1st fruit set, number of days to 1st fruit harvest, number of pickings, number of fruits per cluster, number of fruits per plant, fruit length (cm), fruit diameter (cm), number of locules per fruit, pericarp thickness (mm), number of primary branches per plant, plant height (cm), average fruit weight (g), fruit yield per plant (kg), fruit yield per hectare (q), seed yield per fruit (g), seed yield per plant (g) and 100-seed weight (g). Statistical analysis for variance as suggested by Panse and Sukhatme, 1989, phenotypic and genotypic coefficient of variation as given by Burton (1952) and correlation coefficient at phenotypic and genotypic levels according to the formula given by Searle (1961) were used.

RESULTS AND DISCUSSION

The success of breeding programme depends upon quantum of variability present in the available germplasm. Analysis of variance showed that the genotypes were significantly different for all the characters studied. This indicates the presence of sufficient genetic variability to be exploited in a breeding programme as also reflected in the broad range observed for each trait. SK-T-63 (27.13) followed by SK-T-26 (28.40) and SK-T-66 (29.33) recorded minimum number of days to first flowering. Among all the genotypes SK-T-13 (112.40) showed highest number of fruits per plant followed by SK-T-54 (89.53). Maximum average fruit weight was shown by SK-T-26 (88.93 g) followed by SK-T-63 (83.33 g). Among all the genotypes SK-T-63 (977.05 q hec^{-1}) recorded maximum fruit yield per hectare followed by SK-T-51 (970.22 q hec^{-1}).

The higher values of phenotypic coefficients of variation than corresponding genotypic coefficient of variation indicated the predominant role of environment in the expression of traits, which is in confirmation with the results obtained by Asati *et al.*, 2008 and Mohamed *et al.*, 2012. Highest phenotypic and genotypic coefficients of variation (PCV and GCV) were observed for fruit yield per hectare (PCV= 60.19 %; GCV= 59.65%), fruit yield per plant (PCV= 60.10%; GCV= 59.56%) and no. of fruits per plant (PCV= 56.80%; GCV= 56.58%). Similar findings were also reported by Kumar *et al.*, 2014 and Ashish *et al.*, 2017.

Heritability is used in predicting the expected progress to be achieved through selection. In the present study, the high heritability was noticed for number of fruits per plant (99.22%), seed yield per plant (98.77%), average fruit weight (98.38%), fruit yield per hectare (98.21%), fruit yield per plant (98.20%), 100 seed weight (97.62%) and days to first fruit harvest (97.15%). High heritability can be attributed to the greater role of additive gene and additive x additive gene action, which can be exploited by following simple selection. Genetic advance is the improvement over the base population that can potentially be made from selection for a character. High genetic advance as per cent of mean was observed for fruit yield per hectare (121.79%), fruit yield per plant (121.59%), number of fruits per plant (116.11 %), seed yield per plant (113.04%), average fruit weight (95.25%), pericarp thickness (90.96%), no. of pickings (66.27%) and no. of locules per fruit (58.12%). This is in conformity with the findings of Ashish *et al.*, 2017. Estimating the real effects of selection, heritability alone is not sufficient and genetic advance along with heritability is more useful. High heritability coupled with high genetic advance as per cent of mean were observed for number of fruits per plant, seed yield per plant, average fruit weight, fruit yield per hectare, fruit yield per plant, pericarp thickness, number of locules and number of pickings. Similar observations were obtained by Haydar *et al.*, 2007 and Mohamed *et al.*, 2012. It suggested that these traits could be considered as reliable indices for selection and higher response of these traits could be expected from selection.

Genotypic correlation coefficients were found higher than the corresponding phenotypic correlation coefficients for all the characters. This might be due to the masking effect of environment in the total expression of the genotypes resulting in the reduced phenotypic association. The yield per hectare displayed positive correlation with number of pickings, number of fruits per plant, fruit length, fruit diameter, pericarp thickness, number of locules per fruit, number of primary branches, number of fruits per cluster, plant height, average fruit weight, and fruit yield per plant. Similar correlation were reported by Samadia *et al.*, 2006; Maurya *et al.*, 2011,

Madhurina and Paul., 2012, and Kumar *et al.*, 2014. However, yield per hectare was negatively correlated with days to first flowering, days to first fruit set and days to first fruit harvest both at phenotypic and genotypic level. These findings suggested that average fruit weight had significant and positive correlation with number of pickings, fruit length, fruit diameter, number of locules per fruit, pericarp thickness, number of primary branches per plant. Also, fruit yield per plant and fruit yield per hectare had significant and positive correlation with number of pickings, number of fruits per plant, fruit length, fruit diameter, number of locules per fruit, pericarp thickness, number of primary branches per plant, number of fruits per cluster, plant height and average fruit weight. Hence, selection based on these traits would be useful

CONCLUSION

Based on the finding of present investigation it can be concluded that variability present among the genotypes for all the characters indicated that considerable scope existed for the improvement of tomato cultivars through selections. Out of 78 germplasm lines, SK-T-63, SK-T-26, SK-T-66, SK-T-54, SK-T-51 and SK-T-21 were found superior for most of the characters. These superior genotypes can be used for future breeding programme.

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Table 1. Range, general mean, standard error mean and variability parameters in tomato (*Solanum lycopersicum* L.)

Character	Range	General Mean	Standard error mean	Coefficient of variation (%)		Heritability in broad sense h^2 (%)	Genetic Advance	Genetic Advance as % of mean.
				PCV (%)	GCV (%)			
No. of days to first flowering	27.13 - 42.40	33.77	0.55	8.50	8.00	88.58	5.24	15.51
No. of days to first fruit set	35.33 - 50.06	43.71	0.53	7.73	7.42	92.30	6.42	14.70
No. of days to first fruit harvest	60.86 - 86.00	77.22	0.53	7.13	7.02	97.15	11.02	14.27
No. of pickings	3.46 - 15.06	7.76	0.27	33.32	32.74	96.54	5.14	66.27
No. of fruits per plant	10.73 - 112.40	29.19	0.83	56.80	56.58	99.22	33.90	116.11
Fruit length (cm)	2.20 - 5.96	3.86	0.14	27.26	26.41	93.85	2.03	52.72
Fruit diameter(cm)	2.13 - 6.33	3.82	0.15	29.26	28.38	94.07	2.16	56.70
No. of locules per fruit	2.06 - 7.13	3.62	0.15	30.16	29.17	93.54	2.10	58.12
Pericarp thickness(mm)	0.80 - 6.66	3.13	0.15	45.68	44.91	96.66	2.84	90.96
No. of primary branches per plant	2.46 - 4.20	3.13	0.17	16.52	13.25	64.34	0.68	21.90
No. of fruits per cluster	1.80 - 5.00	3.05	0.19	19.57	15.98	66.67	0.82	26.88
Plant height (cm)	42.46 - 135.00	68.46	1.33	25.11	24.88	98.17	34.77	50.78
Av. fruit weight (g)	11.26 - 88.93	37.79	1.29	46.99	46.61	98.38	36.00	95.25
Fruit yield per plant (kg)	0.22 - 2.61	1.05	0.04	60.10	59.56	98.20	1.27	121.59
Fruit yield per hac (q)	83.04 - 977.05	389.70	17.98	60.19	59.65	98.21	474.64	121.79
Seed yield per fruit (g)	0.11 - 0.22	0.15	0.002	15.03	14.84	97.44	0.04	30.18
Seed yield per plant(kg)	1.67 - 13.26	4.57	0.16	55.55	55.21	98.77	5.16	113.04
100 Seed weight	0.15 - 0.33	0.26	0.003	16.02	15.83	97.62	0.08	32.22

Table 2. Estimates of genotypic (above diagonal) correlation coefficients among different characters in tomato (*Solanum lycopersicum* L.)

Characters	DTEF	DTEFS	DTEFH	NOP	NOF/P	FL	FD	NOL/F	PT	NOPB/P	NOF/C	PH	AWFW	FY/P	FY/H	SY/F	SY/P	100SW
DTEF	7.307	0.467**	0.438**	-0.418**	-0.288**	-0.163*	-0.164*	-0.211*	-0.125	-0.282**	-0.117	-0.083	-0.210**	-0.391**	-0.392**	-0.325**	-0.424**	0.016
DTEFS		10.54	0.577**	-0.429**	-0.145*	-0.347**	-0.340**	-0.252**	-0.259**	-0.253**	-0.121	-0.142*	-0.279**	-0.312**	-0.313**	-0.121	-0.217**	-0.202*
DTEFH			29.47	-0.561**	-0.490**	0.013	0.015	-0.102	-0.076	-0.533**	-0.345**	-0.279**	0.065	-0.205**	-0.205**	-0.105	-0.521**	0.007
NOP				6.456	0.535**	0.129*	0.189**	0.170*	0.291**	0.499**	0.420**	0.435**	0.144*	0.456**	0.456**	0.166*	0.607**	-0.022
NOF/P					272.98	-0.165*	-0.170*	-0.110	-0.081	0.303**	0.481**	0.497**	-0.177**	0.406**	0.405**	-0.072	0.893**	-0.389**
FL						1.041	0.978**	0.501**	0.519**	0.150*	-0.127	0.012	0.877**	0.661**	0.661**	0.248**	0.009	0.413**
FD							1.179	0.526**	0.599**	0.132	-0.117	0.045	0.913**	0.687**	0.687**	0.272**	0.033	0.413**
NOL/F								1.115	0.372**	0.202**	-0.03	0.134	0.581**	0.454**	0.455**	0.804**	0.205**	0.335**
PT									1.978	0.107	-0.162	0.222**	0.493**	0.375**	0.375**	0.233**	0.063	0.400**
NOPB/P										0.172	0.460**	0.288**	0.041	0.233**	0.234**	0.136	0.382**	0.031
NOF/C											0.238	0.436**	-0.135	0.122	0.123	-0.072	0.444**	-0.137
PH												290.1	0.002	0.241**	0.241**	0.001	0.457**	-0.123
AWFW													310.43	0.775**	0.775**	0.427**	0.101	0.356**
FY/P														0.392	1.000**	0.392**	0.635**	0.030
FY/H															54054.3	0.393**	0.635**	0.030
SY/F																0.0005	0.302**	0.220**
SY/P																	6.370	-0.269**
100SW																		0.001

Where DTEF= Days to first flowering, DTEFS= Days to first fruit set, DTEFH= Days to first fruit harvest, NOP= No. of pickings, NOF/P= No. of fruits per plant, FL= Fruit length, FD= Fruit diameter, NOL/F= No. of locules per fruit, PT= Pericarp thickness, NOPB/P= No. of primary branches/ plant, NOF/C= No. of fruits/ cluster, PH= Plant height, AWFW= Average fruit weight, FY/P= Fruit yield/ plant, FY/H= Fruit yield/ hectare, SY/F= Seed yield/ fruit, SY/P= Seed yield/ plant and 100SW= 100 Seed Weight.

Table 3. Mean performance of different genotypes of tomato (*Solanum lycopersicum* L.)

Germplasm	DTF	DTFFS	DTFFH	NOP	NOF/P	FL	FD	NOL/F	PT	NOPB	NOF/C	PH	AWFW	FY/P	FY/H	SY/F	SY/P	100SW
SK-T-1	35.45	43.33	78.60	10.36	24.43	4.80	5.16	4.86	4.00	3.46	3.80	87.33	49.66	1.21	449.28	0.151	3.68	0.305
SK-T-2	32.53	44.13	81.13	9.30	28.06	4.70	4.63	4.03	4.00	4.20	3.93	91.00	39.46	1.10	409.57	0.147	4.13	0.302
SK-T-3	38.20	47.53	81.20	7.13	18.33	4.66	4.46	4.10	5.80	3.46	2.80	69.46	32.66	0.60	221.55	0.142	2.60	0.287
SK-T-4	34.93	45.13	75.93	3.96	15.13	5.23	5.50	4.86	4.46	3.13	3.46	67.26	41.66	0.63	232.94	0.138	2.09	0.307
SK-T-5	35.20	47.26	83.80	4.10	21.46	5.30	4.70	7.13	4.06	2.60	2.40	62.40	53.60	1.15	426.95	0.228	4.90	0.331
SK-T-6	38.60	46.13	80.73	5.86	15.20	4.60	4.56	2.26	4.60	3.00	3.46	51.93	48.40	0.73	272.19	0.131	2.00	0.322
SK-T-7	34.40	42.33	72.26	10.03	24.06	4.16	4.40	4.03	4.00	3.66	2.86	64.20	40.73	0.98	363.74	0.141	3.40	0.306
SK-T-8	36.40	40.00	79.93	9.23	31.33	5.20	5.06	4.06	3.46	2.46	2.93	53.00	58.66	1.84	681.34	0.140	4.41	0.248
SK-T-9	34.40	43.66	80.20	10.76	27.26	4.50	4.50	3.93	3.86	3.00	3.00	94.06	38.26	1.04	385.70	0.140	3.82	0.305
SK-T-10	33.60	37.06	76.13	5.63	22.06	4.80	4.56	4.00	4.00	3.00	3.00	81.53	50.26	1.10	410.44	0.142	3.13	0.328
SK-T-11	34.26	42.20	80.60	7.46	21.86	4.26	4.36	3.20	3.16	3.46	2.60	81.93	34.53	0.75	279.74	0.141	3.09	0.283
SK-T-12	33.86	40.06	78.06	11.86	17.40	4.50	4.73	4.13	3.73	2.46	3.00	54.06	56.86	0.99	366.56	0.150	2.62	0.278
SK-T-13	32.86	41.40	65.53	15.06	112.40	2.43	2.23	2.73	1.00	4.13	5.00	135.00	12.46	1.40	518.81	0.118	13.26	0.198
SK-T-14	32.80	39.86	65.53	10.50	53.60	3.60	3.20	3.40	3.33	3.80	3.53	55.20	17.66	0.94	350.01	0.168	9.02	0.283
SK-T-15	32.20	43.60	81.46	9.26	13.86	4.60	4.23	4.26	3.00	3.26	3.13	60.66	28.80	0.40	147.98	0.146	2.03	0.259
SK-T-16	32.60	41.53	63.66	11.73	35.40	3.66	3.33	3.00	4.06	4.20	3.20	59.26	22.33	0.79	293.27	0.138	4.90	0.256
SK-T-17	30.40	46.46	76.33	6.73	46.40	3.16	3.16	3.00	0.80	3.53	4.20	55.53	19.20	0.89	330.55	0.128	5.93	0.205
SK-T-18	36.33	39.86	77.80	5.66	28.13	3.43	3.43	2.20	1.03	2.80	3.16	55.26	19.53	0.54	203.11	0.113	3.19	0.211
SK-T-19	35.13	43.53	81.00	6.93	17.33	3.36	3.40	4.20	5.20	3.00	3.03	97.13	25.86	0.44	165.70	0.156	2.72	0.315
SK-T-20	33.26	40.00	75.60	8.96	25.33	4.56	4.43	4.73	3.40	3.13	2.36	60.73	46.60	1.17	436.61	0.156	3.97	0.312
SK-T-21	33.73	43.86	79.20	10.06	35.43	5.93	6.13	5.00	5.73	3.60	2.86	73.26	72.80	2.57	954.97	0.182	6.97	0.318
SK-T-22	34.40	45.40	80.60	4.73	17.33	4.36	4.60	3.00	1.20	3.26	3.46	52.80	41.26	0.71	264.56	0.147	2.56	0.279
SK-T-23	34.33	45.73	76.20	7.50	23.26	3.10	2.60	3.00	1.33	3.13	3.26	52.86	21.33	0.49	183.24	0.152	3.55	0.296
SK-T-24	31.93	43.33	74.60	6.60	17.46	2.76	2.46	3.80	1.00	3.53	2.86	52.53	29.26	0.51	189.56	0.166	2.90	0.328
SK-T-25	31.60	39.60	67.13	9.23	36.80	4.13	3.93	4.33	2.00	4.00	3.00	63.00	33.73	1.24	459.89	0.146	5.39	0.287
SK-T-26	28.40	35.33	60.86	9.30	29.06	5.96	6.33	5.66	4.80	3.86	3.60	81.86	88.93	2.57	956.59	0.185	7.66	0.304
SK-T-27	32.73	41.46	77.53	3.46	21.46	4.63	4.03	3.73	1.60	2.60	3.00	73.26	47.86	1.02	380.39	0.132	2.83	0.316
SK-T-28	33.46	42.53	80.00	3.53	22.40	3.33	2.86	3.20	2.00	2.86	2.73	55.20	19.06	0.42	157.68	0.168	3.78	0.260
SK-T-29	33.20	36.40	70.53	9.83	19.33	4.63	4.16	2.60	3.00	2.86	3.13	63.86	33.53	0.65	239.87	0.127	2.46	0.276
SK-T-30	33.93	41.20	62.53	9.83	36.33	3.76	3.33	3.06	1.00	3.80	3.13	86.86	21.53	0.78	289.74	0.138	5.02	0.197
SK-T-31	34.33	42.06	74.66	8.26	54.06	2.73	2.86	3.06	4.00	3.06	3.93	47.46	24.60	1.33	492.35	0.142	7.69	0.217
SK-T-32	31.40	41.33	66.26	9.50	66.26	2.70	2.76	2.73	3.93	3.13	3.26	97.20	21.53	1.42	528.17	0.132	8.76	0.212
SK-T-33	32.66	43.73	77.00	10.46	19.46	3.10	2.90	4.00	5.00	3.46	2.80	77.13	20.06	0.39	144.89	0.188	3.67	0.253
SK-T-34	32.53	45.26	77.33	8.60	41.46	4.73	4.33	2.46	2.06	3.73	3.20	53.00	42.73	1.77	656.90	0.135	5.59	0.241
SK-T-35	32.06	43.13	77.80	7.40	16.80	2.93	2.73	2.20	2.20	3.13	2.93	68.93	26.80	0.45	166.77	0.127	2.14	0.230
SK-T-36	35.60	44.93	79.60	5.66	13.80	3.03	2.13	4.00	2.80	3.86	3.46	48.13	22.86	0.31	116.02	0.162	2.24	0.262
SK-T-37	31.46	46.40	77.33	7.86	30.46	2.60	2.76	2.33	2.86	2.73	3.06	58.40	22.20	0.67	250.41	0.155	4.72	0.249
SK-T-38	31.60	45.53	77.80	6.43	37.46	3.43	3.63	2.73	4.83	3.00	2.66	67.73	32.80	1.22	454.79	0.135	5.06	0.323
SK-T-39	33.66	45.66	70.06	12.50	49.46	2.60	2.73	3.46	3.26	3.46	3.73	90.13	21.26	1.05	389.20	0.185	9.17	0.293
SK-T-40	33.86	43.46	80.46	7.86	38.13	2.80	2.90	3.86	1.13	2.80	2.53	67.93	23.06	0.88	325.87	0.158	6.03	0.202

SK-T-41	42.40	45.86	83.00	5.83	13.46	2.33	2.60	4.00	1.33	2.46	3.60	76.26	21.66	0.29	108.20	0.157	2.12	0.287
SK-T-42	33.93	40.80	80.80	7.80	23.46	5.13	5.56	3.86	6.66	3.13	3.00	88.33	59.93	1.40	520.53	0.135	3.18	0.234
SK-T-43	34.20	41.40	77.80	8.30	25.46	4.10	4.36	3.26	5.33	2.80	3.40	81.60	37.53	0.95	353.88	0.138	3.53	0.268
SK-T-44	31.73	41.06	70.06	8.50	63.46	2.83	2.73	4.73	2.00	3.20	3.26	79.13	24.13	1.53	566.93	0.177	11.25	0.196
SK-T-45	33.33	46.13	81.86	4.10	21.06	2.53	2.43	3.80	1.13	3.06	2.60	58.33	23.86	0.49	184.30	0.161	3.40	0.157
SK-T-46	37.86	45.60	75.60	7.03	25.46	4.50	4.96	3.20	4.26	3.13	2.60	87.60	43.00	1.09	405.61	0.144	3.67	0.262
SK-T-47	31.93	44.53	76.53	9.33	38.46	3.73	3.90	3.80	4.26	3.20	2.60	61.06	32.33	1.24	461.36	0.158	6.07	0.196
SK-T-48	31.73	47.13	82.80	6.83	29.46	4.83	4.90	4.73	2.53	3.00	3.13	82.13	61.53	1.81	671.70	0.182	5.37	0.198
SK-T-49	31.33	45.20	79.60	8.10	32.40	5.56	5.70	5.13	4.46	2.73	2.80	45.53	70.26	2.27	843.26	0.175	5.68	0.297
SK-T-50	35.00	46.26	76.86	10.03	29.46	2.93	2.86	3.80	2.13	3.00	2.86	74.66	30.80	0.91	335.97	0.159	4.68	0.273
SK-T-51	29.66	41.33	71.80	12.90	33.26	5.10	5.90	6.06	4.60	3.53	3.46	69.20	78.73	2.61	970.22	0.215	9.80	0.285
SK-T-52	38.66	45.66	86.00	3.66	20.33	4.16	4.53	4.20	2.13	3.13	2.46	47.73	51.26	1.04	386.62	0.158	3.21	0.288
SK-T-53	33.00	45.73	82.80	9.70	33.33	4.90	5.16	4.66	4.00	3.80	3.20	73.86	76.06	2.53	939.25	0.168	9.32	0.267
SK-T-54	32.00	47.60	72.26	10.33	89.53	2.36	2.23	2.20	3.00	2.80	3.40	102.00	11.26	1.01	373.70	0.135	12.14	0.196
SK-T-55	35.26	44.13	83.26	4.86	17.46	2.93	2.93	2.20	2.53	2.46	2.26	47.66	30.20	0.52	195.40	0.131	2.30	0.278
SK-T-56	31.00	44.00	80.80	4.93	15.13	4.43	4.40	2.46	2.86	3.00	3.00	42.46	48.20	0.73	270.52	0.138	2.09	0.250
SK-T-57	32.86	44.00	77.86	9.00	29.53	5.26	5.10	4.66	1.73	3.20	3.20	53.06	68.60	2.02	749.93	0.198	5.86	0.285
SK-T-58	37.73	48.93	85.53	5.16	21.93	4.33	3.90	2.13	3.00	2.46	2.73	67.26	50.13	1.10	407.27	0.128	2.80	0.261
SK-T-59	34.53	41.46	83.33	8.36	30.80	3.30	3.06	2.06	3.00	3.13	3.60	72.20	28.46	0.87	324.23	0.131	4.05	0.278
SK-T-60	29.93	47.00	81.33	8.80	19.80	2.63	2.66	2.53	2.13	3.06	3.46	83.13	18.20	0.36	132.71	0.147	2.91	0.216
SK-T-61	31.13	40.80	80.86	11.43	41.46	4.43	4.80	2.86	3.80	2.80	2.60	75.20	50.93	2.11	782.08	0.138	5.75	0.226
SK-T-62	31.53	45.73	80.73	5.10	20.93	4.83	4.53	3.73	2.60	2.46	2.60	75.86	54.26	1.13	419.86	0.148	3.11	0.264
SK-T-63	27.13	36.40	70.40	13.73	31.66	5.43	5.86	6.00	5.86	3.73	3.80	92.86	83.33	2.61	977.05	0.215	8.17	0.251
SK-T-64	32.40	39.80	70.66	8.36	15.13	4.20	4.33	2.46	4.00	2.46	2.00	46.86	43.80	0.66	244.80	0.145	2.20	0.321
SK-T-65	32.73	39.93	74.53	6.16	24.46	4.96	4.83	3.60	5.00	3.66	2.66	76.53	51.00	1.24	462.48	0.158	3.88	0.269
SK-T-66	29.33	36.26	70.46	7.16	25.73	3.03	3.10	6.13	4.00	2.80	3.06	78.46	33.93	0.87	324.06	0.214	5.51	0.280
SK-T-67	33.46	49.06	81.06	5.30	17.73	2.26	2.73	3.00	4.40	2.46	2.00	56.80	23.80	0.42	156.51	0.148	2.62	0.301
SK-T-68	32.46	47.06	79.80	6.33	19.46	2.56	2.43	2.73	1.00	2.53	3.80	48.13	21.66	0.42	155.95	0.158	3.08	0.243
SK-T-69	39.53	48.00	80.60	3.86	21.73	2.60	2.56	2.33	1.06	3.00	3.00	60.93	19.26	0.42	156.59	0.134	2.91	0.205
SK-T-70	32.60	46.40	80.53	6.93	17.86	2.50	2.70	2.46	2.80	3.13	2.60	52.00	21.00	0.36	137.38	0.138	2.47	0.237
SK-T-71	33.66	48.86	77.80	4.20	10.73	2.53	2.43	3.26	1.13	3.13	2.73	43.46	20.93	0.22	83.04	0.156	1.67	0.246
SK-T-72	41.20	50.06	82.40	4.73	21.80	2.20	2.23	2.53	1.20	3.13	4.00	87.20	21.60	0.47	174.96	0.137	2.99	0.207
SK-T-73	35.73	46.40	81.40	4.13	23.00	3.26	3.03	3.26	3.00	2.46	2.80	70.80	35.40	0.81	302.22	0.135	3.12	0.219
SK-T-74	33.86	45.20	80.26	8.13	24.46	2.40	2.30	3.93	1.80	2.86	2.80	57.33	23.60	0.58	214.72	0.148	3.64	0.229
SK-T-75	35.46	48.53	78.20	7.26	46.60	5.03	4.26	3.73	3.40	2.80	2.80	92.60	51.46	2.39	888.47	0.157	7.34	0.206
SK-T-76	41.13	48.53	78.26	7.40	15.60	3.40	3.70	3.40	4.00	2.73	2.60	55.66	37.66	0.59	219.17	0.138	2.15	0.230
SK-T-77	36.53	45.40	81.00	5.33	15.80	4.10	4.00	4.60	3.20	3.26	1.80	61.00	40.53	0.64	237.76	0.171	2.71	0.228
SK-T-78	32.20	41.60	81.93	6.86	44.53	4.80	4.26	2.33	2.13	2.80	2.46	46.66	43.13	1.91	710.43	0.145	6.45	0.215
C.D 5%	1.56	1.51	1.50	0.77	2.35	0.42	0.43	0.44	0.42	0.49	0.55	3.74	3.64	0.13	50.57	0.00	0.45	0.01
C.D. 1%	2.06	1.99	1.98	1.02	3.11	0.55	0.58	0.59	0.55	0.65	0.73	4.94	4.80	0.18	66.77	0.00	0.59	0.01
C.V	2.87	2.14	1.20	6.19	5.01	6.76	7.12	7.66	8.35	9.86	11.30	3.39	5.97	8.05	8.04	2.40	6.15	2.47