Combining ability studies for maturity, growth, yield and quality traitsinTomato tomato (*Solanum lycopersicum*L.)

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Abstract

A study was conducted atVegetable Research Farm, Vegetable ScienceDivision, SKUAST- Kashmir, Shalimar, Indiato determine the general and specific combining abilities for maturity, growth, yield and quality traits in tomato by crossing 12 parents in a diallelMethod II and Model I of Griffingmating designduring *Kharif*season2020. The F1 progenies of the sixty-six crosses (excluding reciprocals) were evaluated along with the twelve parents in RandomizedBlock Design during *Kharif*season2021 at three locations.At Vegetable Research Farm of Division of Vegetable Science, SKUAST- Kashmir, Shalimar, twelve diverse lines of tomato (*Solanum lycopersicum* L.) were crossed in a diallel fashionas per the Method II and Model I of Griffing (1956 a, b), to generate sixty-six crosses during Kharif 2020. These sixty-six crosses (excluding reciprocals)were evaluated along with the twelve parents in RandomizedBlock Design during *Kharif*season2021 at three locations.The observations were recorded on eighteen diverse traits.The analysis of variance for general combining ability (GCA) and specificcombining ability (SCA) revealed significant mean squares due to gca GCAand sca SCAfor all the traits under consideration.Themeansquares due to gca×x environments and sca×x environments were found significant for most of the characters. None of the parentspossessed significant and desirable general combining abilityGCA for all the traits. Different parents were found to reveal desirable general combining ability for different traits.Similarly, none of the crossespossessed significant and desirable specific combining ability for all the traits. However, different crosses were found to reveal desirable specificcombining abilitySCA for different traits.

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Key words: Tomato, Genetic Improvement, General Combining Ability, Specific Combining Ability, Agronomic Traits

Comments

The abstract lacks a good introductory statement and logical conclusion or take-home message.

The key results are absent. Those that could have been captured are as below:

Parents exhibiting significant and desirable GCA effects for most of thetraits were SKAU-T-165690, SKAU-T-914091, SKAU-T-914108, SKAU-T-617047,SKAU-T-164334 and SKAU-T-914106. Thus, theseparents could be selected for use in future crop improvement programmes anddirect selection for higher values of yield plant^{-1} can be made in advancedgenerationsof their heteroticcrosses. Crosses with significant and desirable SCA effects for most ofthe traits were SKAU-T-02 × SKAU-T-164334, SKAU-T-914103 × SKAU-T-914091, SKAU-T-914113 × SKAU-T-165690, SKAU-T-165690 × SKAU-T-145057, SKAU-T-914108 × SKAU-T-914106 and SKAU-T-914103 × SKAU-T-165690.

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Introduction

Tomato (*Solanum lycopersicum*L. Syn. *Lycopersicon esculentum* Mill.) belongs to family Solanaceae with chromosome number 2n = 24 (Peralta *et al.*, 2005). It is one of the most popular vegetables in India. Due to its increasing commercial and dietary values, wide adaptability, potential for growing under various cultivation conditions, relatively short life cycle, photoperiodic insensitivity,good productivity, andgood capacity for seed production, it is becoming more and more well-liked on a global scale. Because of these characteristics and several other advantages like relatively small genome, the absence of gene duplication, the ease with which pollination and hybridization can be managed, the capacity for asexual propagation (grafting) and the ability to regenerate entire plants from various explants, it is used as a model plant for both basic and applied research projects (Bai and Lindhot, 2007; Prema *et al*., 2011; Venkadeswaran*et al.*, 2018).

Owing to the economic, nutritional and medicinal importance of the crop, a need-based crop development programmeis necessary. Prior to beginning of any development programme through hybridization, it is necessary to understand the ability of different genotypes to combine. The choice of the best genotypes and the appropriate breeding technique for the creation of improved varieties and hybrids depend heavily on this knowledge. The general and specific combing ability of parents and their progeny can be assessed through a variety of various biometrical procedures. One of these methods is the diallel analysis suggested by Griffing (1956a,b) and Hayman (1954a).

Comments

The introduction is poorly written. The authors need to coherently rewrite this aspect. They need to give a good background of crop, its importance. Clearly state the research problems, the genetic bottlenecks relating to the genetic improvement of the crop and previous efforts by other researchers. Discuss and justify their study within the genetic parameter estimates for the traits being investigated.

Objective of study.

Materials and Methods

Twelve diverse lines of tomato (*Solanum lycopersicum* L.) were crossed in a diallel fashionas per the Method II and Model I of Griffing (1956 a, b), to generate sixty-six crosses at Vegetable Research Farm of Division of Vegetable Science, SKUAST-Kashmir, Shalimar during Kharif 2020. These sixty-six crosses (excluding reciprocals)were evaluated along with the twelve parents in RandomizedBlock Designduring *Kharif*season2021at three locations *viz*. E_1: Vegetable Experimental Farm, Division of Vegetable Science, SKUAST-Kashmir, Shalimar; E_2: Vegetable Seed Multiplication Farm, SKUAST-Kashmir, Shuhama and E_3: Faculty of Agriculture, SKUAST-Kashmir, Wadura.The observations were recorded on eighteen diverse traits. Thedata thusgeneratedwassubjectedtostandardstatistical procedures.

Comments

THIS SECTION SHOULD BE WELL ORGANIZED POSSIBLY FOLLOWING THE FOLLOWING ORDER:

Experimental site

Soil sample collection, preparation and analysis

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Experimental material, layout, design and trial management
Mating design and hybridization procedure
Data collection
Statistical and genetic analyses

Results and Discussion

The analysis of variance for general combining ability (GCA) and specificcombining ability (SCA) (Table 1)revealed significant mean squares due to gca and sca for all the traits under consideration. Themeansquares due to gca×x environments were found significant for all characters except number of days to first flowering, number of days to first fruit set, number of days to first fruit harvest, number of primary branches plant^{-1}, seed yield fruit^{-1} and 100 seed weight. Themeansquares duesca×x environments were found significant for all characters except number of days to first fruit set, number of days to first fruit harvest, number of primary branches plant^{-1}, number of fruits cluster^{-1}, plant height, average fruit weight, seed yield fruit^{-1} and 100 seed weight. The above findings are in accordance with the findings of Dharva*et al.* (2018), Kumar *et al.* (2018), Rajkumar *et al.* (2018), Mishra *et al.* (2020), Veena *et al.* (2019), Bhajantri*et al.* (2022),Ummyiah*et al.*,(2021) andUmmyiah*et al.*,(2015(a).

The general combining ability analysis (Table 2) showed that none of the parentspossessed significant and desirable general combining ability for all the traits. However, different parents were found to reveal desirable generalcombiningabilityfordifferenttraits.The parents exhibiting significant and desirable GCA effects for most of thetraits were SKAU-T-165690, SKAU-T-914091, SKAU-T-914108, SKAU-T-617047,SKAU-T-164334 and SKAU-T-914106 in individual and data pooled over environments. Hence, theseparents could be selected for use in future crop improvement programmes anddirect selection for higher values of yield plant^{-1} can be made in advancedgenerationsof their heteroticcrosses.Similar findings with respect to GCA effects were also reported Jadav *et al.* (2017), Kaushik *et al.* (2018), Rajkumar *et al.* (2018), Veena*et al.* (2019), Ummyiah*et al.*,(2015(b) and Vekariya*et al.* (2019), Kumar *et al.* (2020), and Lone *et al.* (2022).

Thespecific combining ability analysis for different traitsshowed that none of the crossespossessed significant and desirable specific combining ability for all the traits. However, different crosses were found to reveal desirable specificcombining ability for different traits.The crossesexhibiting significant and desirable SCA effects for most ofthe traits were SKAU-T-02 ×x SKAU-T-164334, SKAU-T-914103 ×x SKAU-T-914091, SKAU-T-914113 ×x SKAU-T-165690, SKAU-T-165690 ×x SKAU-T-145057, SKAU-T-914108 ×x SKAU-T-914106 and SKAU-T-914103 ×x SKAU-T-165690in individual and data pooled over environments. Hence, these crosses with desirable SCA formaximum traits, could be selected for use in future breeding programmes i.e.,hybriddevelopment. Similar findings with respect to SCA effects were also reported by Dharva*et al.* (2018), Kaushik *et al.* (2018), Rajkumar *et al.* (2018), Veena*et al.* (2019), Vekariya*et al.* (2019), Mishra *et al.* (2020), Liu *et al.* (2021), Ummyiah*et al.*2015(c) and Arora *et al.* (2022).

These desirable specific cross combinations resulted out of crosses between the parents with high ×x high, high ×x low, low ×x high, low ×x low, high ×x average, average ×x low or low ×~~x~~ average general combining ability (Table 3). The perusal of results indicated that superior crosses for different traits involved all types of combiners, which was reported by several workers in most of the crop species. Dass *et al*. (1997) concluded that good cross combination is not always as a result of high ×~~x~~ high general combiners. The superiority of crosses involving high ×~~x~~ low or average ×~~x~~ low combiners as parents could be explained on the basis of interaction between positive alleles from good/average combiners and negative alleles from the poor combiners as parents (Dubey, 1975). The high yield of such crosses would be non-fixable and thus could be exploited for heterosis breeding. The superior cross combination involving low ×~~x~~ low general combiners could result from over dominance and epistasis (Rehman *et al.*,1981). The crosses could be exploited for isolation of pure lines through pedigree method of breeding involving progeny testing, since that non-additive component is predominant.

Comments

Which cross combination(s) were the best performing families per trait studied?

This write-up lacks conclusion. The authors should conclude based on their objectives, demonstrating mechanistic links among their findings.

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Comment [C2]: The authors should thoroughly revise and ensure that both in-text citations and detailed catalogued references are in conformity with the requirements of this journal. Inconsistent referencing styles have been utilized.

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Table 1(a): **Analysis of variance for combining ability for maturity, growth, yield and quality traits in Tomato (*Solanum lycopersicum*L.) [Pooled data over environments]**

Source of variation	d.f	Number of days to first flowering	Number of days to first fruit set	Number of days to first fruit harvest	No. of pickings	No. of fruits cluster^{-1}	No. of fruits plant^{-1}	Fruit length (cm)	Fruit diameter (cm)	No. of locules fruit^{-1}
environments	2	795.97**	839.63**	730.69**	89.19**	14.52**	1484.69**	14.04**	15.11**	15.24**
gca	11	23.52**	56.00**	211.40**	13.68**	0.98**	893.28**	3.83**	4.68**	3.83**
sca	66	22.54**	28.25	67.38**	13.51**	0.48**	645.05**	2.38**	2.78**	2.77**
gca x environments	22	0.31	0.19	0.39	0.26**	0.11**	6.27**	0.06**	0.03*	0.03*
sca × environments	132	0.41*	0.22	0.26	0.33**	0.03	5.04**	0.04**	0.03*	0.03**
Error	154	--	--	--	--	--	--	--	--	--
Pooled	462	0.30	0.28	0.31	0.06	0.03	0.65			

*, ** Significant at 5 and 1 per cent levels, respectively

Table 1(b): **Analysis of variance for combining ability formaturity, growth, yield and quality traits in Tomato (*Solanum lycopersicum*L.) [Pooled data over environments]**

Source of variation	d.f	Pericarp thickness (mm)	No. of primary branches plant^{-1}	Plant height (cm)	Average fruit weight (g)	Fruit yield plant^{-1}(kg)	Fruit yield hectare^{-1}(q)	Seed yield fruit^{-1}(g)	Seed yield plant^{-1}(g)	100 Seed weight
environments	2	19.98**	28.84**	516.74**	1724.07**	4.59**	631967.71**	16.02**	47.72**	0.18**
gca	11	6.33**	1.65**	584.22**	1366.07**	0.97**	134265.13**	15.94**	20.97**	1.20**
sca	66	4.64**	0.37**	871.15**	791.07**	0.85**	117545.17**	15.97**	13.76**	0.40**
gcax environments	22	0.10**	0.03	5.97**	4.40**	0.01**	2529.13**	0.03	0.24**	0.02
sca × environments	132	0.07**	0.01	1.54	1.25	0.01**	1982.03**	0.01	0.16**	0.09
Error	154	--	--	--	--	--	--	--	--	--
Pooled	462	0.02	0.02	2.48		296.86		0.07	0.02	0.01

*, ** Significant at 5 and 1 per cent levels, respectively

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Table 2(a): Estimation of general combining ability effects of parents for maturity, growth, yield and quality traits in Tomato (*Solanum lycopersicum*L.)

Parents	Number of days to first flowering	Number of days to first fruit set	Number of days to first fruit harvest	No. of pickings	Number of fruits cluster^{-1}	Number of fruits plant^{-1}	Fruit length (cm)	Fruit diameter (cm)	No. of locules fruit^{-1}
SKAU-T-01	1.252**	0.581**	1.756**	0.364**	0.088*	-5.672**	0.743**	0.784**	0.549**
SKAU-T-914103	-0.537**	-0.858**	-2.511**	1.270**	0.358**	10.909**	-0.068*	-0.144**	-0.148**
SKAU-T-914113	-0.802**	-2.201**	-5.238**	0.281**	0.049	1.783**	-0.119**	-0.294**	0.027
SKAU-T-620438	0.150	0.303**	0.076	0.032	0.073**	-1.008**	-0.118**	-0.153**	-0.146**
SKAU-T-165690	-0.670**	-0.138	-1.385**	0.060	0.054*	0.831**	0.170**	0.264**	0.469**
SKAU-T-914108	-0.677**	-0.465**	0.495**	-0.140	0.147**	3.762**	0.144**	0.231**	0.221**
SKAU-T-02	-0.181*	-0.364**	-2.819**	-0.473**	-0.083**	-2.622**	-0.070*	-0.051	-0.348**
SKAU-T-914106	-0.215**	-1.311**	-0.192*	0.168*	0.167**	4.284**	-0.005	0.087**	0.219**
SKAU-T-617047	-0.790**	-1.626**	-0.649**	-0.050	0.014	1.638**	0.511**	0.541**	0.446**
SKAU-T-914091	-0.256**	-0.006	-1.932**	0.469**	0.115**	1.308**	0.133**	0.168**	0.095**
SKAU-T-145057	1.401**	1.942**	1.593**	-1.065**	-0.218**	-5.776**	-0.226**	-0.124**	-0.107**
SKAU-T-164334	0.046	0.396**	1.303**	0.356**	-0.013	0.869**	0.191**	0.109**	0.054
SE± (g_i)	**0.08149**	**0.07943**	**0.08312**	**0.08381**	**0.03101**	**0.11920**	**0.03089**	**0.02656**	**0.02750**
SE±(g_i-g_j)	**0.12036**	**0.11733**	**0.12278**	**0.12380**	**0.04581**	**0.17607**	**0.04563**	**0.03923**	**0.04063**
C.Dat 5%	**0.23653**	**0.23056**	**0.24127**	**0.18447**	**0.06825**	**0.34600**	**0.06799**	**0.05845**	**0.06054**

*, ** Significant at 5 and 1 per cent levels, respectively

Table 2(b): Estimation of general combining ability effects of parents for maturity, growth, yield and quality traits in Tomato (*Solanum lycopersicum*L.)

Parents	Pericarp thickness (mm)	No. of primary branches plant^{-1}	Plant height (cm)	Average fruit weight (g)	Fruit yield plant^{-1} (kg)	Fruit yield hectare^{-1} (q)	Seed yield fruit $^{-1}$ (g)	Seed yield plant $^{-1}$ (g)	100 Seed weight (g)
SKAU-T-01	0.857**	0.090**	3.408**	6.816**	-0.024	-9.029**	-0.004**	-0.984**	0.035**
SKAU-T-914103	-0.296**	0.403**	6.086**	-6.961**	-0.032	-12.104**	-0.009**	0.933**	0.004**
SKAU-T-914113	-0.126**	0.210**	-1.545**	-4.760**	-0.084**	-30.981**	0.002**	0.304**	0.011**
SKAU-T-620438	-0.112**	0.157**	-1.651**	-5.083**	-0.116**	-43.007**	-0.004**	-0.315**	0.002**
SKAU-T-165690	0.302**	0.004	3.084**	4.202**	0.147**	54.254**	0.009**	0.469**	0.012**
SKAU-T-914108	0.247**	0.044*	4.387**	8.071**	0.258**	96.163**	0.007**	1.279**	0.004**
SKAU-T-02	-0.273**	-0.123**	-1.057**	1.580**	0.004	1.691	0.003**	0.451**	-0.011**
SKAU-T-914106	0.583**	-0.237**	1.473**	1.490**	0.044*	16.122**	-0.001	-0.520**	0.024**
SKAU-T-617047	0.460**	0.042	4.557**	9.988**	0.230**	85.386**	0.005**	0.035	-0.022**
SKAU-T-914091	-0.010	0.222**	0.852**	1.132**	0.142**	52.260**	0.001*	0.196**	-0.016**
SKAU-T-145057	-0.176**	-0.217**	-6.649**	-1.386**	-0.197**	-73.229**	-0.003**	-1.040**	-0.003**
SKAU-T-164334	-0.043	0.150**	-1.224**	4.889**	0.177**	65.492**	0.010**	0.295*	0.014**
SE± (g_i)	**0.04100**	**0.02210**	**0.23312**	**0.19636**	**0.01810**	**2.54544**	**0.00040**	**0.06183**	**0.00066**
SE±(g_i-g_j)	**0.06056**	**0.03264**	**0.34434**	**0.29004**	**0.02680**	**3.75986**	**0.00069**	**0.09138**	**0.00098**
C.Dat 5%	**0.09024**	**0.04863**	**0.67666**	**0.56996**	**0.03985**	**7.38855**	**0.00103**	**0.13609**	**0.00146**

*, ** Significant at 5 and 1 per cent levels, respectively

Table 3a: Best specific cross combinations for different traits on the basis of sca and gca of parents involved inTomato (*Solanum lycopersicum*L.) (based on pooled analysis)

S. No.	Traits	Crosses	sca effect	gca effect of parents	S. No.	Traits	Crosses	sca effect	gca effect of parents
1.	Number of days to first flowering	SKAU-T-02 × SKAU-T-164334	-6.130**	A × L	6.	No. of fruits plant $^{-1}$	SKAU-T-914113 × SKAU-T-145057	37.674**	H × L
		SKAU-T-914113 × SKAU-T-165690	-4.326**	H × H			SKAU-T-620438 × SKAU-T-617047	16.874**	L × H
		SKAU-T-165690 x SKAU-T-145057	-2.730**	H x L			SKAU-T-914108 x SKAU-T-914091	15.345**	H x H
		SKAU-T-914113 x SKAU-T-145057	-2.531**	H x L			SKAU-T-02 x SKAU-T-914091	12.551**	L x H
		SKAU-T-02 x SKAU-T-914091	-2.361**	A x H			SKAU-T-02 x SKAU-T-164334	7.573**	L x H
2.	Number of days to first fruit set	SKAU-T-02 x SKAU-T-164334	-7.764**	L x H	7.	Fruit length (cm)	SKAU-T-914113 x SKAU-T-620438	4.438**	L x L
		SKAU-T-914113x SKAU-T-165690	-6.199**	H x L			SKAU-T-914103x SKAU-T-914091	2.245**	L x H
		SKAU-T-914106 x SKAU-T-617047	-4.431**	H x H			SKAU-T-914113x SKAU-T-165690	1.820**	L x H
		SKAU-T-914103 x SKAU-T-617047	-4.328**	H x H			SKAU-T-165690 x SKAU-T-145057	1.693**	H x L
		SKAU-T-02 x SKAU-T-914091	-2.651**	L x L			SKAU-T-914106 x SKAU-T-617047	1.596**	L x H
3.	Number of days to first fruit harvest	SKAU-T-02 x SKAU-T-164334	-10.579**	L x H	8.	Fruit diameter (cm)	SKAU-T-914103x SKAU-T-914091	2.489**	L x H
		SKAU-T-914113x SKAU-T-165690	-10.078**	H x H			SKAU-T-914113x SKAU-T-165690	2.453**	L x H
		SKAU-T-914103x SKAU-T-165690	-9.272**	H x H			SKAU-T-02 x SKAU-T-164334	1.911**	L x H
		SKAU-T-914113 x SKAU-T-145057	-7.656**	H x L			SKAU-T-165690 x SKAU-T-145057	1.659**	H x L
		SKAU-T-620438 x SKAU-T-617047	-6.772**	L x H			SKAU-T-914106 x SKAU-T-617047	1.317**	H x H
4.	No. of pickings	SKAU-T-02 x SKAU-T-164334	4.602**	L x H	9.	No. of locules fruit $^{-1}$	SKAU-T-02 x SKAU-T-164334	2.629**	L x L
		SKAU-T-02 x SKAU-T-914091	4.170**	L x H			SKAU-T-914103 x SKAU-T-617047	1.573**	L x H
		SKAU-T-620438 x SKAU-T-617047	4.079**	L x L			SKAU-T-914113x SKAU-T-165690	1.520**	L x H
		SKAU-T-914113 x SKAU-T-145057	2.349**	H x L			SKAU-T-914103x SKAU-T-914091	1.389**	L x H
		SKAU-T-01 x SKAU-T-617047	2.131**	H x L			SKAU-T-914108 x SKAU-T-914106	0.956**	H x H
5.	No. of fruits cluster $^{-1}$	SKAU-T-914103 x SKAU-T-617047	0.922**	H x L	10.	Pericarp thickness (mm)	SKAU-T-02 x SKAU-T-164334	3.076**	L x L
		SKAU-T-914108 x SKAU-T-914091	0.687**	H x H			SKAU-T-914103x SKAU-T-914091	2.619**	L x L
		SKAU-T-02 x SKAU-T-164334	0.640**	L x L			SKAU-T-914106 x SKAU-T-617047	1.480**	H x H
		SKAU-T-620438 x SKAU-T-617047	0.596**	H x L			SKAU-T-914103 x SKAU-T-914108	1.387**	L x H
		SKAU-T-914113x SKAU-T-165690	0.526**	L x A			SKAU-T-914113x SKAU-T-165690	1.227**	L x H

Comment [C3]: Revise across tables using appropriate symbol.

Table 3b: Best specific cross combinations for different traits on the basis of sca and gca of parents involved inTomato (*Solanum lycopersicum*L.) (based on pooled analysis)

S. No.	Traits	Crosses	sca effect	gca effect of parents	S. No.	Traits	Crosses	sca effect	gca effect of parents
11.	No. of primary branches plant^{-1}	SKAU-T-914103× SKAU-T-165690	0.655**	H × L	15.	Fruit yield hectare^{-1} (q)	SKAU-T-914113x SKAU-T-165690	483.644**	L × H
		SKAU-T-914108 x SKAU-T-914106	0.655**	A x L			SKAU-T-02 x SKAU-T-164334	479.138**	L x H
		SKAU-T-02 x SKAU-T-164334	0.622**	L x H			SKAU-T-914103x SKAU-T-914091	445.200**	L x H
		SKAU-T-914106 x SKAU-T-617047	0.591**	L x L			SKAU-T-914108 x SKAU-T-914106	417.305**	H x H
		SKAU-T-914103x SKAU-T-914091	0.481**	H x H			SKAU-T-165690 x SKAU-T-145057	392.574**	H x L
12.	Plant height (cm)	SKAU-T-914113 x SKAU-T-145057	34.640**	L x L	16.	Seed yield fruit^{-1} (g)	SKAU-T-02 x SKAU-T-164334	0.058**	H x H
		SKAU-T-02 x SKAU-T-164334	26.949**	L x L			SKAU-T-620438 x SKAU-T-617047	0.044**	L x H
		SKAU-T-620438 x SKAU-T-617047	18.473**	L x H			SKAU-T-914103x SKAU-T-914091	0.036**	L x A
		SKAU-T-01 x SKAU-T-617047	16.792**	H x H			SKAU-T-914108 x SKAU-T-914091	0.030**	H x A
		SKAU-T-914103x SKAU-T-165690	16.279**	H x H			SKAU-T-914103 x SKAU-T-914108	0.027**	L x H
							SKAU-T-914108 x SKAU-T-164334	0.027**	H x H
13.	Average fruit weight (g)	SKAU-T-914113x SKAU-T-165690	50.958**	L x H	17.	Seed yield plant^{-1} (g)	SKAU-T-914113 x SKAU-T-145057	4.443**	H x L
		SKAU-T-914103x SKAU-T-914091	40.041**	L x H			SKAU-T-620438 x SKAU-T-617047	4.213**	L x L
		SKAU-T-02 x SKAU-T-164334	37.410**	H x H			SKAU-T-02 x SKAU-T-164334	3.769**	H x A
		SKAU-T-165690 x SKAU-T-145057	28.484**	H x L			SKAU-T-914108 x SKAU-T-914106	3.421**	H x L
		SKAU-T-914108 x SKAU-T-914106	27.407**	H x H			SKAU-T-914113x SKAU-T-165690	1.967**	H x H
14.	Fruit yield plant^{-1} (kg)	SKAU-T-914113x SKAU-T-165690	1.297**	L x H	18.	100 seed weight (g)	SKAU-T-914103x SKAU-T-914091	0.073**	H x L
		SKAU-T-02 x SKAU-T-164334	1.283**	L x H			SKAU-T-914103 x SKAU-T-617047	0.072**	H x L
		SKAU-T-914103x SKAU-T-914091	1.198**	L x H			SKAU-T-620438 x SKAU-T-617047	0.054**	H x L
		SKAU-T-914108 x SKAU-T-914106	1.123**	H x A			SKAU-T-165690 x SKAU-T-145057	0.053**	H x L
		SKAU-T-165690 x SKAU-T-145057	1.061**	H x L			SKAU-T-914113x SKAU-T-165690	0.041**	H x H

H: High, L: Low and A: Average