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Genetic variability and Correlation Studies for Vegetative and yield Attributing Traits in Hybrid Seedlings of Peach [*Prunus persica* (L.) Batsch]

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ABSTRACT: The experiment was conducted at Fruit Research Farm at Punjab Agricultural University, Ludhiana. The challenges in the experiment are that fruit set % of different cross combinations and survival of F-1 hybrid seedlings is very low in case of Kala Amritsari × Flordaguard. There is not a single hybrid seedlings are surviving in case of Kala Amritsari × Flordaguard. At 120 days after germination, highest seed germination was recorded in Flordaguard (97.78%) which did not different with Sharbati × Flordaguard (89.69%), highest plant height and petiole length were recorded in hybrid seedlings of Sharbati × Flordaguard 30.48 cm and 6.13mm, respectively. Similarly, leaf number and internodal length in seedlings of Flordaguard × Sharbati. The maximum leaf blade length and width at 120 days after germination were recorded in Sharbati fallowed by Sharbati × Flordaguard. Maximum leaf area was recorded in Sharbati (14.53 cm²) followed by hybrid seedlings of Sharbati × Flordaguard and Flordaguard × Sharbati (13.59 cm^2 and 12.16 cm^2, respectably). Chlorophyll levels in terms of SPAD unit maximum were recorded in the leaves from Flordaguard × Sharbati (42.87) followed by Sharbati Flordaguard (37.40) which did not differ significantly from Sharbati and Flordaguard. In all traits, high phenotypic coefficient of variation (PCV) were noted than the genotypic coefficient of variation (GCV), it was recorded higher in leaf size, leaf area, Fresh shoot weight, Fresh root weight, shoot length, leaf bled length, leaf number and plant height. The genotypic and phenotypic variance were higher in case of Seed germination (%), Shoot length, chlorophyll level (SPAD Units), leaf size, leaf number, leaf area and plant height. Ranges of Heritability in all traits from 11.87 to 94.75, of which most of showed very high heritability, except some traits such as Leaf Blade Ratio and seedlings girth. Traits like shoot length, leaf size, leaf bled length, leaf area, Fresh shoot weight, Fresh root weight and chlorophyll level showed more value of heritability along with high to moderate genetic advance pointing additive gene action, so the selection may be effective for these traits. Plant height was positively correlated with leaf number, seedlings girth, leaf area, root and shoot length, internodal length, petiole length and chlorophyll SPAD value. Seedlings girth was positively associated with all studied traits.

Keywords: Hybridization, variability, heritability, genetic advance, correlation and rootstock breeding.

INTRODUCTION

Rootstock has an important effect on performance of the peach scion cultivars, which includes growth rate, tree size, productivity, nutrient uptake, time of defoliation, bloom time, tree survival, nematode infestation and resistance to canker and PTSL Picolotto *et al.* (2009), Ye *et al.* (2009); Beckman *et al.* (2002). The biotic and abiotic factors mostly determine by rootstocks and play main role in performance of plants. No one rootstock can be rated as an ideal rootstock for all situations. Sharbati variety of peach is used as rootstock in sub-tropical regions of India, because of its wide adaptability to warm climatic conditions, but poor graft compatibility and rooting ability and susceptibility to root-knot nematode. In crop improvement programs, germplasm collection, confirmation of genetic variability and association of traits are very important steps. The presence of high genetic variability and heritability in plats population have more chances to selection and develop a line.

The heritability along with genetic advance over means (GAM) is more fruitful for see the outcome of the selection Ramanjinappa *et al.* (2011). The studies of the correlation are help in for the detect the degree of interaction in various traits and develop breeding method for crop improvement. The selection of a character as a measure to improve one more character depends on the proportion of relationships among them and these relationships are depending on genotypic and phenotypic correlation Imtiyaz *et al.* (2012). For the further improvement an important objective is develop

a superior cultivar with improved yield and good fruit quality. Hence, peach breeding programs are working to provide efficient alternative rootstocks for peach with best rooting capacity, graft harmony, resistance to root-knot nematode, canker, PTS, better adaptation to chlorosis, drought and water logging. The main purpose of this experiment was to assess the variability, heritability and correlations in 16 vegetative and reproductive traits of peach. The obtained information can be useful for select the best genotypes as better rootstocks.

MATERIALS AND METHODS

The experiment was conducted from 2016 to 2018 at the Fruit Research Farm of the Punjab Agricultural University in Ludhiana. The average maximum temperature is 12.9 to 33.9° C and the average minimum temperature is 5.7 to 26.9 °C. The average annual rainfall in this area is about 885 mm. Of these, 75% is the monsoon season, from July to September. The experiment was set up with a randomized block design with 5 replications. The research material consists of two parents and two F1 hybrid peaches, namely Sharbati, Flordaguard, Sharbati × Flordaguard and Flordaguard × Sharbati, are maintained at Fruit Research Farm of the Punjab Agricultural University, Ludhiana.

Stratified seeds were sown in portrays in the month of May to June and seed germination % are workout. After establishment of seedlings of parents and F_1 hybrids in portrays were transplanted under field conditions and 15 uniform healthy seedlings were maintained for each genotype. The plants were raised as per the recommended package and practices for peach cultivation in lower hills or sub-tropical conditions. A total number of 16 observations were recorded from each treatment. Chlorophyll level was measured as SPAD value taken by a chlorophyll meter (SPAD 502 plus Konica Minolta Sensing, Europe B.V.). Morphological characters of the parents and hybrid seedlings were recorded based on Descriptors for Peach. Leaf area (cm^2) of hybrid seedlings was measured by using Leaf Area Meter (CI-203 Area Meter). Growth parameters like plant height (cm), internodal length (cm), leaf blade length and width (cm) carried out with help of scale. Plant girth was worked out in the millimeter with the help of Digital Vernier's Calliper (MitutoyoInc, Japan).

The data obtained from different traits were analyzed statistically by using 'F' test and the significance of difference of means was estimated by LSD test at 5% level of probability Gomez and Gomez, (1984). The data were analyzed by using OP Stat software (http://hau.ernet.in/about/opstat.php) Sheoran *et al.* (1998). Genotypic variance and phenotypic variance, GCV and PCV were workout accordingly method suggested by Burton (1952) and the expected genetic advance for various characters under selection was carried out according to Allard (1960). Al-Jibouri *et al.* (1958) suggest the method for the workout of phenotypic and genotypic correlation coefficients.

RESULTS AND DISCUSSION

Breeding programs for qualitative and quantitative traits require comprehensive information on the extent and type of genotypic variation available. Higher levels of genetic variation were observed in peaches due to the predominance of cross-pollination and exclusive seed reproduction. The data shown in Table 1 revealed that there are significant differences between parents and hybrids for all 16 nutritional and yield-related traits. Parental interactions in hybrids showed significant differences for some traits. Results of experiments revealed that parents and their hybrids have higher genetic variation in different traits.

The data pertaining to the plant growth parameters of the hybrids and the parents were given in Table 1. Maximum height of plant at 120 days after germination was recorded in hybrid seedlings of Sharbati × Flordaguard followed by Flordaguard × Sharbati. Maximum leaf number was recorded in the seedlings of Flordaguard × Sharbati which did not differ significantly with the leaf number in seedlings of Sharbati × Flordaguard. It was closely followed by leaf number in Flordaguard. There were no significant differences in plant girth of seedlings of the parents and hybrids. Internodal length of seedlings showed significant differences, maximum internodal length was recorded in the seedlings of Flordaguard × Sharbati followed by Sharbati × Flordaguard. Length of petiole maximum was recorded in Sharbati × Flordaguard followed by Flordaguard and Flordaguard × Sharbati. Significant difference was found in Leaf blade length and width; maximum was recorded in Sharbati followed by Sharbati × Flordaguard. Leaf blade ratio showed no significant difference only at 120 days after seed germination. The maximum leaf size was recorded in Sharbati followed by hybrid seedlings of Sharbati × Flordaguard and Flordaguard × Sharbati respectively. Similarly, Singh *et al.* (2017) also recorded variation in the plant growth parameters of hybrid seedlings. Highest plant height (160.0 cm) and number of branches (13) after 11 months of planting was recorded in hybrid of FlordaGlo × Tropic Sweet. Parents with low chilling requirement and maximum fruit development period showed maximum seedling growth. Likewise, in almond and peach hybrid seedlings, Shaltout *et al*. (2015) recorded variation in seedling height, stem girth and number of leaves. Maximum leaf area was recorded in Sharbati followed by hybrid seedlings of Sharbati × Flordaguard and Flordaguard × Sharbati respectably. The higher leaf area value in Sharbati and Sharbati × Flordaguard in comparison to Flordaguard might be due to the genotypic effects. Singh *et al.* (2005) also found variation among peach varieties for leaf area with maximum leaf area in Shan-i-Punjab peach followed by Early Grand, Florda Prince and Sharbati.

Table 1: Performance of peach parents and hybrid seedlings for vegetative and reproductive traits.

Genotypes	Height (cm)	Leaf Number	Girth (mm)	Internodal Length (cm)	Petiole length (mm)	Leaf blade length (cm)	Leaf blade width (cm)	Leaf blade ratio (cm)	Leaf size (cm^2)	Leaf area (cm^2)	Chlorophyll level (SPAD units)	Seed Germination %	Root length (cm)	Shoot length (cm)	Fresh Shoot weight (g)	Fresh root weight (g)
Sharbati	24.51	27.14	3.18	1.39	5.00	8.57	1.84	4.70	16.06	14.53	34.60	80.07	17.65	48.30	13.97	6.85
Flordaguard	25.55	31.13	3.21	1.49	5.20	6.03	1.60	4.36	8.40	7.40	34.24	97.78	15.85	42.60	13.91	4.92
Sharbati × Flordaguard	30.48	32.35	3.30	1.68	6.13	7.02	1.69	4.41	11.99	13.59	37.40	89.69	18.91	50.50	14.07	5.60
Flordaguard × Sharbati	29.30	35.50	2.88	1.70	5.20	6.57	1.53	4.36	10.36	12.16	42.87	85.44	17.72	34.68	9.08	4.70
C.V. (%)	**6.792**	**8.84**	**7.73**	**5.55**	**7.79**	**7.25**	**5.54**	**6.34**	**7.93**	**14.53**	**34.60**	**3.42**	**7.20**	**3.75**	**9.39**	**8.78**
LSD (0.05)	**2.57**	**3.84**	**NS**	**0.12**	**0.58**	**0.71**	**0.13**	**NS**	**1.29**	**7.40**	**34.24**	**3.69**	**1.76**	**2.30**	**1.67**	**0.67**

The chlorophyll level in terms of SPAD units was recorded highest in the leaves of seedlings from Flordaguard × Sharbati which was at par with the Sharbati × Flordaguard. The SPAD value in Sharbati × Flordaguard did not differ significantly from the SPAD values in Sharbati and Flordaguard seedlings. The higher SPAD units in Flordaguard × Sharbati may be due to darker green colour leaves. The lower SPAD units in hybrid seedlings of Sharbati seedlings may also be due to the lighter green colour. Guler and Buyuk (2004) and Shaaban and El-Bendary (1999) recorded that nitrogen level in the leaf of cucumber was proportional to SPAD meter reading. The chlorophyll concentration in tomatoes cv. Santa Clara varies from 43.8 to 45.5 SPAD units Guimaraes *et al.* (1999).

The highest seed germination was recorded in Flordaguard (97.78%) than Sharbati × Flordaguard (89.69%). followed by seed germination in Flordaguard × Sharbati (85.44%) and Sharbati (80.07%). The seeds of early maturing low chill peach and nectarine are immature at fruit maturity and show very poor seed germination. Shaltout *et al.* (2015) recorded high seed germination %age (68 to 74%) in peach rootstock hybrids from Om El-Fahm × Okinawa and M. Dalet × Okinawa; and also in parents following self-pollination. Similarly, Singh et al. (2017) also recorded high germination percent in hybrid seeds from FlordaGlo × Tropic Sweet (81.5%), Tropic Beauty × Flordagrand (80.3%) and Flordagrand × Tropic Beauty (68.0 %). The higher germination %ages in the hybrids and the parents in the present studies might be due to higher fruit development period (>100 days) of the seed parent. Fruit development period is a common index for embryo maturity used by peach breeders. The peach varieties which have a fruit developmental period of <80 days need embryo rescue for successful seed germination while, the varieties having a fruit development period of more than >100 days can be germinated after stratification before the drying of the seeds Bacon and Byrne, (2005). The stratification requirement of seed is positively correlated with the seed parents chilling requirements Perez (1990).

The highest root and shoot length was recorded in Sharbati × Flordaguard (17.57 cm and 49.0 cm, respectively) followed by Sharbati (17.44 cm and 47.01 cm, respectively) and Flordaguard (16.49 cm and 42.51 cm). Maximum fresh root weight was recorded in Sharbati (5.86 g) which was followed by fresh root weight in Flordaguard × Sharbati (5.19g). The maximum fresh shoot weight was found in Sharbati × Flordaguard (13.20g) which were at par with other genotypes. The highest shoot dry weight was noted in Sharbati × Flordaguard (7.60g) and it did not differ significantly from shoot dry weight in other genotypes.

Genotypic and phenotypic coefficient of variation, heritability, genetic advance (GA) and associated coefficients are important in disclosing and understanding a clear picture of existing demographic differences and the recruitment of an appropriate developmental approach. Complex traits like yield is influenced by reproductive, vegetative and crop characteristics, as well as environment. Therefore, the diversity of these factors is the sum total of the genetic effects of the affected genes and the influence of the environment. Therefore, it is very important to separate the complete diversity into heritable and non-heritable components because only heritable variations can be used in selection. Genotypic coefficient of variation coupled with heritability estimates and GA give the better picture of the expected value of genetic gain to be obtained from phenotypic selection Burton (1952). Heritability associated with genetic gain to be more useful than heritability values only as it allows predicting the outcome of selecting each of the best genotypes Johnson *et al.* (1955).

Variability level of genotypes was evaluated in the form of genotypic and phenotypic variance, GCV, PCV, heritability, genetic advance and genetic advance mean as indicated in Table 2. Highest genotypic and phenotypic variance were noted in Seed germination % (54.09 and 63.17) fallowed by shoot length (49.32 and 52.05) and SPAD units (13.37 and 18.67) respectably, and moderate in leaf size, leaf number and leaf area and lower level in remaining traits. Level of GCV is slightly lower in all traits than PCV. The range of GCV and PCV were recorded higher in traits like leaf size and leaf area while moderate in fresh shoot and root weight, shoot length, leaf number and plant height. Range of heritability was noted highest for the shoot length (94.75) than leaf size (92.36) and seed germination % (85.62), traits like leaf blade length (81.41), leaf area (80.68) and fresh shoot and root weight (79.14 and 79.18) showed lower % of heritability. GA was recorded higher in shoot length (14.09) fallowed by seed germination % (14.02), leaf size and SPAD units (8.20) whereas GAM% was observed highest for leaf size (70.01), leaf area (61.56) followed by leaf blade length, shoot and root length and fresh root weight (36.15, 34.54, 32.00 and 31.41) respectably. Heritability along with GA recorded higher in Leaf size

and leaf area while moderate in leaf blade length, fresh shoot and root weight and fresh shoot length. Traits like shoot length and seed germination % were showed maximum heritability coupled with maximum GA while higher heritability with moderate GA recorded for leaf size and SPAD units.

Table 2: Genetic parameters of vegetative and reproductive traits of parents and hybrid peach genotypes.

Trait	Genotypic variance	Phenotypic variance	Genotypic coefficient of variation (%)	Phenotypic Coefficient of variation (%)	Heritability (%)	Genetic Advance	Genetic Advance in % of mean
Plant Height	7.59	11.07	10.03	12.12	68.59	6.0	21.94
Leaf number	10.40	18.18	10.23	13.52	57.2	6.4	20.42
Seedlings Girth	0.02	0.08	4.67	9.07	26.59	0.2	6.36
Internodal Length	0.02	0.03	9.34	10.87	73.92	0.3	21.21
Petiole length	0.22	0.40	8.72	11.70	55.59	0.9	17.17
Leaf Blade Length	1.14	1.41	15.17	16.82	81.41	2.5	36.15
Leaf Blade Width	0.02	0.03	7.75	9.51	66.40	0.3	16.66
Leaf Blade Ratio	0.01	0.09	2.33	6.75	11.87	0.1	2.12
Leaf size	10.43	11.29	27.59	28.71	92.36	8.2	70.01
Leaf Area	9.58	11.87	25.96	28.90	80.68	7.3	61.56
SPAD Unit	13.37	18.67	9.72	11.49	71.61	8.2	21.72
Seed germination (%)	54.09	63.17	8.34	9.00	85.62	14.02	15.89
Root length	1.28	2.88	6.45	9.67	44.46	1.56	8.86
Shoot length	49.32	52.05	15.96	16.38	94.75	14.09	32.00
Fresh shoot wt.	0.89	1.13	18.76	20.97	79.94	4.41	34.54
Fresh root wt.	5.72	7.16	17.14	19.25	79.18	1.74	31.41

Traits like seed germination % and shoot length were found effective for selection because having higher value of genotypic and phenotypic variance which show presence of inherent genetic variance. According to the result the estimated level of PCV more than level of GCV, which revealed that there is rarer effect of environment on the traits. High extent of GCV and PCV revealed that presence of broad level of genetic variability in traits like leaf size, area, and number, leaf bled length, and plant height, so level of improvement is higher. Range of the high heritability in the traits like shoots length, leaf size, seed germination %, leaf blade length, leaf area, fresh shoot and root wt. is due to presence of additive gene effect, which revealed that these traits are beast for direct selection. Similarly, vegetative, reproductive and fruit yield traits in papaya, strawberry and agro-morphological traits of *Gossypium herbaceum* and horsegram with high GCV, PCV, heritability and GA was reported by Singh et al. (2018); Davamani *et al.* (2013); Mishra *et al.* (2015); Kumar *et al.* (2021); Priyanka *et al.* (2021) respectably. Maximum range of GCV with maximum heritability in leaf area and size, fresh shoot and root weight and shoot length was suggesting that selection is more fruitful for improvement of traits. Moderate or low level of heritability estimates with low to medium GA were noted in leaf blade ratio, width and seedling is due to presence of non-additive gene actions. Traits, leaf size and area exhibit higher and leaf blade length, shoot length and fresh shoot and root wt. showed common ranges of heritability with maximum range of GAM, so presence of predominance of additive gene action in these traits are good for selection and further improvement.

Genotypic (Table 3) and Phenotypic (Table 4), correlation matrix showed outstanding positive relationship for traits like plant height with leaf number, root length, petiole length and internodal length. Leaf number is highly positively associated with plant height and internodal length, but plant girth is positively associated with length of petiole and shoot, leaf blade width, chlorophyll content and fresh shoot and root weight. A positive outstanding correlation of internodal length was observed with plant height, leaf number and root length, while petiole length is associated with plant height, plant girth, internodal, root and shoot length at phenotypic and genotypic level. Most of leaf traits like leaf blade length, width, and ratio, leaf size and leaf area were positively and significant associated with chlorophyll level, root and shoot length, fresh shoot and root weight and within each trait. In case of chlorophyll content level, a positive significant genotypic and phenotypic correlation was observed in traits like plant girth, leaf blade length, width and ratio, leaf size, leaf area root and shoot length, fresh shoot and root weight. Traits such as root and shoot length positively associated with plant height, plant girth, length of internodal, leaf blade and petiole, leaf blade width and ratio, leaf size, leaf area and chlorophyll content level. Fresh shoot and root weight showed positive significant phenotypic and genotypic correlation with plant girth leaf blade length, leaf blade width, leaf blade ratio, leaf size, leaf area, chlorophyll content level and within each other. Genotypic and phenotypic positive correlation association of plant height, leaf number and girth was observed with internodal length, petiole length, shoot and root length and fresh shoot weight. Positive association of internodal length and petiole length was observed with height of plant, leaf number, root length and height of plant, girth, internodal length and root and shoot length respectably both at phenotypic and genotypic level. Height of the plant was found positively and significantly agree with traits like number of leaf (0.875), internodal length (0.962), petiole length (0.873) and root length (0.703) while, girth of the stem was recorded positively and significantly correlated along with petiole length (0.572), leaf blade width (0.729), chlorophyll content (0.922), shoot length (0.975), fresh shoot weight (0.966) and fresh root weight (0.481) respectably at

genotypic level. Leaf number (0.570), internodal length (0.679), petiole length (0.542) and root length (0.630) had positive significant with plant height while, shoot length (0.500) and fresh shoot weight (0.500) had positive significant with plant girth respectably at phenotypic level.

Table 3: Genotypic Correlations Matrix of vegetative and reproductive traits peach.

Parameters	Plant Height	Leaf number	Plant Girth	Internodal Length	Petiole length	Leaf Blade Length	Leaf Blade Width	Leaf Blade Ratio	Leaf size	Leaf Area	Chlorophyll (SPAD Unit)	Seed germination (%)	Root length	Shoot length	Fresh shoot wt.	Fresh root wt.
Plant Height	1.000															
Leaf number	0.875**															
Girth	-0.154NS	-0.721**														
Internodal Length	0.962**	0.910**	-0.471*													
Petiole length	0.873**	0.334NS	0.572**	0.587**												
Leaf Blade Length	-0.382NS	-0.781**	0.202NS	-0.608**	-0.258NS											
Leaf Blade Width	-0.555*	-0.953**	0.729**	-0.806**	-0.138NS	0.939**										
Leaf Blade Ratio	-0.918**	-0.909**	0.139NS	-0.897**	-0.634**	0.973**	0.937**									
Leaf size	-0.300NS	-0.735**	0.225NS	-0.512*	-0.161NS	0.907**	0.913**	0.922**								
Leaf Area	0.274NS	-0.227NS	-0.085NS	0.080NS	0.263NS	0.842**	0.654**	0.873**	0.890**							
Chlorophyll (SPAD)	0.310NS	-0.418NS	0.922**	-0.023NS	0.781**	0.552*	0.723**	0.688**	0.595**	0.693**						
Seed germination (%)	0.084NS	0.313NS	0.341NS	0.167NS	0.258NS	-0.877**	-0.602**	-0.982**	-0.889**	-0.924**	-0.272NS					
Root length	0.703**	0.134NS	0.130NS	0.557*	0.759**	0.495*	0.288NS	0.178NS	0.575**	0.922**	0.903**	-0.610**				
Shoot length	-0.140NS	-0.744**	0.975**	-0.402NS	0.518*	0.543*	0.842**	0.819**	0.553*	0.416NS	0.934**	-0.077NS	0.414NS			
Fresh shoot wt.	-0.450*	-0.816**	0.966**	-0.604**	0.335NS	0.315NS	0.709**	0.616**	0.289NS	-0.036NS	0.658**	0.252NS	-0.101NS	0.917**		
Fresh root wt.	-0.505*	-0.934**	0.481*	-0.741**	-0.191NS	0.983**	0.960**	0.961**	0.968**	0.677**	0.654**	-0.696**	0.392NS	0.750**	0.625**	1.000

*, **Significant at 0.01 and 0.05 levels of probability, NS= Non significant

Table 4: Phenotypic Correlations Matrix of vegetative and reproductive traits peach.

Parameters	Plant Height	Leaf number	Plant Girth	Internodal Length	Petiole length	Leaf Blade Length	Leaf Blade Width	Leaf Blade Ratio	Leaf size	Leaf Area	Chlorophyll (SPAD Unit)	Seed germination (%)	Root length	Shoot length	Fresh shoot wt.	Fresh root wt.
Plant Height	1.000															
Leaf number	0.570**															
Girth	-0.163NS	-0.375NS														
Internodal Length	0.679**	0.709**	-0.190NS													
Petiole length	0.542*	0.264NS	0.416NS	0.669**												
Leaf Blade Length	-0.351NS	-0.582**	0.139NS	-0.330NS	-0.035NS											
Leaf Blade Width	-0.321NS	-0.549*	0.297NS	-0.401NS	0.125NS	0.813**										
Leaf Blade Ratio	-0.296NS	-0.643**	0.274NS	-0.406NS	-0.195NS	0.594**	0.329NS									
Leaf size	-0.263NS	-0.530*	0.104NS	-0.328NS	-0.010NS	0.960**	0.843**	0.460*								
Leaf Area	0.115NS	-0.215NS	0.112NS	-0.018NS	0.090NS	0.703**	0.438NS	0.467*	0.740**							
Chlorophyll (SPAD)	0.157NS	-0.283NS	0.241NS	0.054NS	0.520*	0.435NS	0.485*	0.110NS	0.510*	0.489*						
Seed germination (%)	0.068NS	0.214NS	0.346NS	0.141NS	0.274NS	-0.755**	-0.384NS	-0.386NS	-0.767**	-0.745**	-0.195NS					
Root length	0.630**	0.198NS	0.012NS	0.350NS	0.458*	0.270NS	0.245NS	0.164NS	0.344NS	0.483*	0.382NS	-0.415NS				
Shoot length	-0.074NS	-0.520*	0.500*	-0.318NS	0.385NS	0.495*	0.665**	0.258NS	0.530*	0.301NS	0.793**	-0.101NS	0.303NS			
Fresh shoot wt.	-0.272NS	-0.609**	0.500*	-0.558*	0.068NS	0.254NS	0.578**	0.231NS	0.264NS	-0.019NS	0.504*	0.210NS	-0.005NS	0.814**		
Fresh root wt.	-0.429NS	-0.728**	0.395NS	-0.491*	0.032NS	0.865**	0.792**	0.609**	0.858**	0.629**	0.480*	-0.515*	0.110NS	0.609**	0.380NS	1.000

*, **Significant at 0.01 and 0.05 levels of probability, NS= Non significant

The genotypic correlation coefficients of vegetative and yield traits were more than phenotypic correlation coefficients in almost all samples, found that effect of environment repress the phenotypic association between these characters. In pomegranate, Mir *et al.* (2009) noted positive and significant correlations for yield per plant along the traits likewise plant height, fruit dia., weight and fruits per plant. In same trend Singh et al. (2018) in case of papaya yield per plant noted positive and significant correlations along yield traits like height of plant at flower initiation and at first fruit maturity, length of petiole, inflorescence and leaf, days to flowering and fruit maturity, number of fruits/ plant, fruit weight, dia., length and fruit cavity index and stem dia., fruit yield per plant in strawberry was confidently and significantly correlated with yield allocated traits at both phenotypic and genotypic level Mishra *et al*. (2015).

On the basis of beyond argumentation, it is understandable that use the seedlings of Sharbati × Flordaguard as a rootstock purpose in peach as compare to Sharbati, Flordaguard and Flordaguard × Sharbati seedlings. Since Sharbati × Flordaguard seedlings have higher seedling height, girth, root and shoot length. Traits like seed germination % and shoot length were found effective for selection because having higher value of genotypic and phenotypic variance which show presence of inherent genetic variance. High extent of GCV and PCV revealed that presence of broad level of genetic variability in traits like leaf size, area, and number, leaf bled length, and plant height, so level of improvement is higher. Range of the high heritability in the traits like shoots length, leaf size, seed germination %, leaf blade length, leaf area, fresh shoot and root wt. is due to presence of additive gene effect. The genotypic correlation coefficients of vegetative and yield traits were more than phenotypic correlation

coefficients in almost all samples. These traits are important for direct selection of hybrid seedlings for the further use in peach breeding programme as a rootstock and for the evaluation in next generation for check the performance of hybrid seedlings and select the better one for future use.

CONCLUSION

On the basis of beyond argumentation, it is understandable that use the seedlings of Sharbati × Flordaguard as a rootstock purpose in peach as compare to Sharbati, Flordaguard and Flordaguard × Sharbati seedlings. Since Sharbati × Flordaguard seedlings have higher seedling height, girth, root and shoot length. Traits like seed germination % and shoot length were found effective for selection because having higher value of genotypic and phenotypic variance which show presence of inherent genetic variance. High extent of GCV and PCV revealed that presence of broad level of genetic variability in traits like leaf size, area, and number, leaf bled length, and plant height, so level of improvement is higher. Range of the high heritability in the traits like shoots length, leaf size, seed germination %, leaf blade length, leaf area, fresh shoot and root wt. is due to presence of additive gene effect. The genotypic correlation coefficients of vegetative and yield traits were more than phenotypic correlation coefficients in almost all samples.

FUTURE SCOPE

These traits are important for direct selection of best hybrid seedlings. Selected seedlings are further use in peach breeding programme as a rootstock purpose and for the evaluation in next generation for check the performance of hybrid seedlings and select the better one for future use.

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Conflict of Interest. The authors should declare that they do not have any conflict of interest.

REFERENCES

Al-Jibouri, H. A., Miller, P. A., and Robinson, H. F. (1958). Genotypic and Environmental Variances and Co-variances in an Upland Cotton Cross of Interspecific Origin. *Agronomy Journal, 50*: 633-636.

Allard, R.W. (1960). Principles of Plant Breeding. John Wiley and Sons Ltd., New York, USA.

Bacon, T. A. and Byrne, D. H. (2005). Relationships of fruit development period, seed germination, seedling survival, and % dry weight of ovule in peach. *HortScencei, 30*: 833-833.

Beckman, T. G., Okie, W. R. and Nyczepir, A. P. (2002). Influence of scion and rootstock on incidence of pceach tree short life. *Acta Horticulture, 592*: 645-648.

Burton, G. W. (1952). Quantitave inheritance in grasses. *Proc. 6th Int. Grassland Cong., 1*: 277-83.

Davamani, J. Balamohan, T. N. and Sudha, R. (2013). Evaluation of papaya (*Carica papaya* L.) hybrids for yield and papain recovery. *Journal of Horticulture Science, 8*: 165-71.

Gomez, K. A. and Gomez, A. A. (1984). Statistical Procedures for Agricultural Research (2 edn.). John Wiley and Sons, New York, pp. 680.

Guimaraes, T. G., Fontes, P. C. R., Pereira, P. R. G., Alvarez, V. V. H. and Monnerat, P. H. (1999). Relations among chlorophyll contents determined by portable meter and nitrogen forms in leaves of tomatoes cultivated in two soil types. *Bragantia, 58*: 209-216.

Guler, S. and Buyuk, G. (2004). Relationships among chlorophyll-meter reading value, leaf N and yield of cucumber and tomatoes. *Proc III Balkan Symposium on Vegetables and Potatoes, 729*: 307-311.

Imtiyaz, A.W., Bhat, M.Y., Banday, F.A., Khan, A., Hassan, G. I., Abid, A. L. and Bhat, T. A. (2012). Correlation studies of morphological and economic traits in pomegranate (*Punica granatum* L.). *Plant Archives, 12*: 943-46.

Johnson, H. W., Robinson, H. F. and Comstock R. E. (1955). Estimates of genetics and environmental variability in soybean. *Agronomy Journal, 47*: 314-18.

Mir, M.M., Neelofar and Bisati, I. A. (2009). Path coefficient analysis in pomegranate (*Punica granatum* L.). *Advance in Plant Sciences, 22*: 269-71.

Mishra, P. K., Ram, R. B. and Kumar, N. (2015). Genetic variability, heritability, and genetic advance in strawberry (*Fragariax ananassa* Duch.). *Turkish Journalof Agricultureand Forestry, 39*: 451-58.

Perez-Gonzalez, S. (1990). Relationship between parental blossom season and speed of seed germination in peach. *Horticulture Sciences, 25*: 958–60.

Picolotto, L., ManicaBeto, R., Pazin, D., Pasa, M. S., Schmitz, J. D., Prezotto, M. E., Betemps, D., Bianchi, V. J. and Fachinello, J. C. (2009). Vegetative, phenological and productive characteristics of peach trees cultivar Chimarrita grafted on different rootstocks. *Pesquisa Agropecuaria Brasileira, 44*: 583-89.

Ramanjinappa, V., Arunkumar, K. H., Hugar, A. and Shashibhaskar, M. S. (2011). Genetic variability in okra (*Abelmoschus esculentus* L. Moench.) *Plant Archives, 11*: 435-37.

Shaaban, M. M. and El-Bendary, A. A. (1999). Evaluation of nitrogen status for snap bean, potatoes and cucumber under field conditions using a portable chlorophyll meter. *Alexandria J. Agric Res., 44*: 191-200.

Shaltout, A. S., Wakeel, H. E., Nahla, A. A. and Ghada, S. (2015). Production of new almond-peach hybrid rootstocks resistance to root-knot nematode. *British Biotechnology Journal, 6*: 126-135.

Sheoran, O. P., Tonk, D. S., Kaushik, L.S., Hasija, R. C. and Pannu, R. S. (1998). Statistical Software Package for Agricultural Research Workers. Recent Advances in information theory, Statistics and Computer Applications by D.S. Hooda and R.C. Hasija, Department of Mathematics Statistics CCS HAU, Hisar, pp. 139-143.

Singh, A. K., Sharma, R. M., Kher, R. and Jasrotia, A. (2005). Introduction and Evaluation of Pear and Peach Cultivars under Subtropics of Jammu Region. *Proc 7thIntSymp on Temperate Zone Fruits in the Tropics and Subtropics-Part Two, 696*: 25-29.

Singh, H., Thakur, A. and Jawandha, S. K. (2017). Summer stratification and germination: A viable option for recovery of hybrid seedlings in low chill peach and

nectarines. *Indian Journal of Horticulture, 74*: 151-155.

Singh, P., Prakash, J., Goswami, A. K., Singh, K., Hussain, J., and Singh, A. K. (2018). Genetic variability and correlation studies for vegetative, reproductive and yield attributing traits in papaya. *IndianJournal of Horticulture, 75*: 1-7.

Ye H., Wanf W., Kiu G., Zhu L. and Jia, K. (2009). Resistance mechanismof Prunus rootstocks to root-knot nematode, *Meloidogyne incognita*. *Fruits*, *64*: 295-303.

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