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Research Note

Genetic variability for pod yield and related traits in garden pea (*Pisum sativum* L.)

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Abstract
An experiment was conducted to examine the nature of genetic variability, correlation, association of various traits with pod yield and their direct and indirect effects for effective selection in garden pea. The experimental material comprising of 41 genotypes including four checks namely, 'Lincoln', 'Azad P-1', 'Palam Priya' and 'Punjab-89' was evaluated in randomized complete block design with three replications during 2009-10 and 2010-11. Significant genetic variations was observed for pod yield and related traits. PCV and GCV were high for pods per plant and pod yield per plant. High heritability coupled with high genetic advance was observed for pods per plant and pod yield per plant. Correlation and path coefficient analysis revealed that pods per plant, pod length, seeds per pod and nodes per plant for fresh pod yield per plant could be considered as the best selection parameters for evolving high yielding genotypes.

Key words
Garden pea, genotypes, PCV, GCV, correlation

Pea (*Pisum sativum* L.) is a member of family Leguminoseae, contains higher amount of protein having essential amino acids mainly lysine (Nawab *et al.* 2008). It is an essential winter vegetable in the northwestern Himalayas of India (Pandey *et al.* 2006). Mediterranean region is the primary center of diversity with secondary centre in Ethiopia (Blixt, 1970). Being biological nitrogen fixing legume, its value has long been accepted for maintaining and restoring soil fertility, conservation and enhancement of physical properties of the soil by virtue of its deep root system. Due to diverse agro-climatic conditions in Himachal Pradesh, the crop is grown round the year, yielding profitable returns to the growers (Sharma *et al*. 2020). The consumers have their specific preference for hill grown peas because of its characteristic flavour, sweetness and freshness. In the high altitude areas, it is grown as an off-season cash crop during summer whereas in winter, it is cultivated in low and mid hills.

The development of absolute breeding and improvement program needs thorough genetic information and an understanding of genetic variation for yield and its components. Genetic variability is considered as an essential aspect for crop improvement program for obtaining high yielding progenies. Lack of ample genetic variability for economically important character is one of the reasons attributed for insignificant progress in crop improvement. The success of any breeding programme depends upon the nature and magnitude of genetic variability present in the germplasm (Adunga and Labuschangne, 2003) which provides better chances of selecting desirable types (Vavilov, 1951). Therefore, genetic restructuring of pea germplasm is the first step to identify the potential genotypes for use in breeding programme. The inclusion of diverse parents in hybridization programmes serves the purpose of combining desirable genes to obtain desirable recombinants. Thus, this investigation was undertaken to gather information on genetic variability in 41 genotypes of garden pea (*Pisum sativum* L.) which may help to select suitable genotypes for future breeding programs.

The field experiment was carried out at the Vegetable Research Farm, CSK Himachal Pradesh Agricultural University Palampur. The experimental materials comprised of 41 genotypes of garden pea (28 isolated from induced mutations, seven through hybridization followed by selection and six other released varieties) were collected from different sources. The genotypes were assessed in randomized complete block design with three replications and data were recorded on pod yield along with component traits. Each genotype was grown in three rows of 3 m length in winter 2009-10 and during winter 2010-11 in one row of 4 m length with inter and intra-row spacing of 45 cm and 10 cm, respectively. The observations were recorded on randomly taken ten plants of each genotype in each replication followed by computing their means for the various traits *viz*., days to first flower, first flowering node, days to 50% flowering, days to first pick, the number of branches, internodal length (cm), nodes per plant, plant height (cm), pod length (cm), seeds per pod, shelling (%), pods per plant, pod yield per plant (g), total soluble solids (ºbrix) with the help of ERMA hand refractrometer, ascorbic acid (mg) method as described by AOAC (1970), total sugars (%) as per procedure given by Dubois *et al.* (1956), reducing sugars (%) as per procedure given by Miller (1972) and starch content (%) using method given by Sadasivasam and Manickam (1996).

For all the traits studied genetic variability (%), correlation coefficient analysis and path coefficient analysis were calculated. The data were statistically analyzed as per the standard statistical procedures for randomized block design (Gomez and Gomez, 1983). The genotypic, phenotypic and environmental coefficients of variation were estimated method given by Burton and De Vane (1953). Heritability in broad sense (h^2_{bs}) and expected genetic advance (GA) was calculated as per the formula given by Burton and De Vane (1953) and Johnson *et al.* (1955). The phenotypic, genotypic and environmental coefficients of correlation were calculated as suggested by Al-Jibouri *et al.* (1958). Estimates of direct and indirect effects of component traits on green pod yield per plant were done through path coefficient analysis obtained according to method given by Dewey and Lu (1959).

The knowledge of phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) is useful in predicting the amount of variation present in the given genetic stock which in turn helps in formulating an efficient breeding programme. The estimates of PCV were higher than corresponding GCV for all characters studied (**Tables 1**) which indicated that the apparent variation is not only due to genotypes but also due to the influence of environment. Hence, the precaution has to be taken in making selection for these characters on the basis of phenotype alone as environmental variation is unpredictable in nature. PCV and GCV were high for pod yield per plant. This indicated that there is substantial variability ensuring ample scope for the improvement of these traits through selection. Earlier workers Gupta *et al.* (2006), Nawab *et al.* (2008) and Guleria *et al.* (2009) have also reported high PCV and GCV pods per plant and pod yield per plant. The moderate estimates of PCV and GCV were noted for the number of branches, internodal

Table 1. Estimates of different parameters of variability for different characters in garden pea

Traits	Range	Population Mean	GCV (%)	PCV (%)	h^2_{bs}	GA (%)
Days to first flower	81-90	84.80±1.03	2.48	3.88	40.85	3.26
First flower node	12.30-15.70	13.89±0.31	3.48	6.45	29.05	3.86
Days to 50% flowering	89-100	94.41±1.05	3.23	4.23	58.20	5.07
Days to first picking	119-129	125.21±1.14	1.49	2.68	30.81	1.70
Number of branches	1.27-2.53	1.76±0.11	16.07	22.01	53.33	24.18
Internodal length (cm)	2.66-6.52	5.25±0.13	13.36	14.53	84.53	25.30
Nodes per plant	15.47-19.87	17.51±0.38	5.47	7.62	51.64	8.10
Plant height (cm)	34.51-81.67	61.43±1.25	14.26	15.11	89.16	27.75
Pod length (cm)	6.59-13.35	8.74±0.19	12.94	13.97	85.91	24.72
Seeds per pod	3.92-8.37	5.98±0.17	14.37	15.94	81.28	26.69
Shelling (%)	39.10-48.93	43.96±0.95	4.29	6.80	39.71	5.56
Pods per plant	4.89-16.52	9.77±0.51	24.92	28.06	78.85	45.58
Pod yield per plant (g)	14.13-16.25	39.89±1.62	27.90	30.00	88.74	54.15
Total soluble solids (ºbrix)	15.03-18.93	17.58±0.34	3.57	5.95	35.98	4.41
Ascorbic acid (mg)	12.38-18.82	14.97±0.34	10.00	11.45	76.18	17.97
Total sugars (%)	5.93-8.57	6.97±0.14	7.48	8.86	71.18	13.00
Reducing sugars (%)	2.84-4.03	3.40±0.13	8.41	12.54	44.95	11.61
Starch content (%)	18.90-30.15	24.66±0.73	10.59	12.82	68.26	18.02

GCV, PCV and ECV represent genotypic, phenotypic and environmental coefficients of variations, respectively; h^2bs: Heritability in Broad sense; GA (%): Genetic advance as percent of mean length, plant height, pod length, seeds per pod and starch content. The moderate estimates suggest that the direct selection for these traits should be considered cautiously. These moderate estimates have also been reported by Kuksal *et al.* (1983) and Guleria *et al.* (2009). Remaining traits days to first flower, first flower node, days to 50% flowering, days to first picking, nodes per plant, shelling (%), total soluble solids showed low PCV and GCV. The low estimates for days to first picking were also reported by Pathak and Jamwal (2002) and Sharma *et al.* (2007).

The information on heritability estimates is useful in studying the inheritance of quantitative characters as well as for planning breeding programmes with desired degree of expected general progress. High heritability estimates (>60%) were observed for inter-nodal length, plant height, pod length, pods per plant, pod yield per plant, seeds per pod, ascorbic acid, total sugar and starch content (**Table 1**). The high heritability estimates for these characters revealed the lesser influence of environment and greater role of genetic component of variation. For an effective selection programme, it is useful to study genetic advance along with heritability. Moderate heritability estimates were observed for days to first flower, days to 50% flowering, days to first picking, the number of branches, nodes per plant, shelling (%), total soluble solids and reducing sugars whereas first flower node exhibited low heritability estimates. Low heritability indicated that the character is highly influenced by environmental factors and genetic improvement through selection will be difficult due to masking effects of the environment on the genotypic effects.

The high expected genetic advance expressed as per cent of mean (>30%) was observed for pods per plant and pod yield per plant (**Table 1**). Earlier workers have also reported high genetic advance for plant height (Chaudhary and Sharma 2003; Gupta *et al*. 2006; Sharma *et al.* 2007). High heritability coupled with high genetic advance was observed for pods per plant and pod yield per plant (**Table 1**). This suggested the significance of additive gene action for the inheritance of these characters and improvement could be carried about by phenotypic selection. The genotypic correlation coefficients were of higher magnitude than the corresponding phenotypic ones which shown that though there is a strong inherent association between various characters, the phenotypic expression of the correlation gets reduced under the influence of environment. There are positive associations of pod yield per plant with pods per plant, seeds per pod, pod length, internodal length, plant height, shelling (%) and ascorbic acid. Earlier reports of many research workers have also showed a significant and positive association for pod yield per plant with pods per plant (Sharma *et al.* 2007; Sharma *et al.* 2009). Pod yield per plant had revealed a negative association at both genotypic and phenotypic levels with days to 50% flowering and days to first picking. Days to first flower showed a negative association with pod yield. Similar results were also reported by Gupta and Singh (2006). Number of branches exhibited a positive association with internodal length, plant height, pod length and pods per plant at both phenotypic and genotypic levels. Shelling (%) revealed a positive correlation with pods per plant. Positive associations of pods per plant with ascorbic acid and total sugars at genotypic level were also reported. Total soluble solids also revealed a negative association with ascorbic acid at genotypic level. Sirohi *et al*. (2006) reported a positive association of branches per plant with plant height, pod length and pods per plant (**Table 2**).

The end product, yield has often been described as the product of its component traits which show inter-dependence (Wilson, 1987). The path coefficient analysis allows partitioning of correlation coefficients into direct and indirect effects of various traits towards dependent variable and thus, helps in considering the cause-effect relationship as well as effective selection. It plays significant role in determining the degree of relationship between yield and its component effects and also permits critical examination of specific factors that provide a given correlation. Path analysis for pod yield revealed that the indirect contribution of pods per plant and pod length increased the total association of number of branches, internodal length, plant height, seeds per pod and ascorbic acid at both phenotypic and genotypic levels. It was observed that the maximum direct effects of pods per plant and pod length at phenotypic level and that of pod length followed by pods per plant, days to first picking, internodal length and shelling (%) at genotypic level on pod yield per plant (**Table 3**). Earlier researchers have also reported direct and positive effects of pods per plant (Nawab *et al.* 2008), pod length (Sharma *et al.* 2007), seeds per pod (Chaudhary and Sharma, 2003) days to first picking and nodes per plant (Ramesh and Tewatia, 2002) on the total association with pod yield per plant. The indirect effect of pods per plant and pod length increased the total association of number of branches, internodal length, plant height and seeds per pod at both phenotypic and genotypic levels. The magnitude of these characters was so high that they nullified the negative direct effect of number of branches, seeds per pod and plant height at genotypic level. Additionally, internodal length, nodes per plant and shelling (%) also added significantly through their indirect contribution to the number of branches, pod length and seeds per pod along with contribution of shelling (%) and internodal length to pods per plant at genotypic level (**Table 3**).

It can be concluded that the high heritability coupled with high genetic advance for pods per plant and pod yield per plant revealed the importance of additive gene action. Therefore, the phenotypic selection would be effective for improvement in the early generations. Selection on the basis of pods per plant, pod length, seeds per pod and plant height will be effective for isolating plants with high yielding genotypes based on association and direct/ indirect effects.

Table 2. Estimates of phenotypic (P) and genotypic (G) correlation coefficients for different pairs of horticultural traits in garden pea

Trait		Days to first flower	First flower node	Days to 50% flowering	Days to first picking	Number of branches	Internodal length (cm)	Nodes per plant	Plant height (cm)	Pod length (cm)	Seeds per pod	Shelling (%)	Pods per plant	Total soluble solids (° brix)	Ascorbic acid (mg)	Total sugars (%)	Reducing sugars (%)	Starch content (%)	Pod yield per plant (g)
First flower node	P	0.19*																	
	G	0.66*																	
Days to 50% flowering	P	0.80*	0.18*																
	G	1.01*	0.53*																
Days to first picking	P	0.36*	0	0.53*															
	G	0.84*	0.36*	0.96*															
Number of branches	P	-0.04	-0.07	-0.08	-0.05														
	G	-0.13*	-0.01	-0.14*	-0.29*														
Internodal length (cm)	P	-0.07	0	-0.12	-0.15*	0.18*													
	G	-0.09	-0.12	-0.15*	-0.28*	0.28*													
Nodes per plant	P	0.14*	0.25*	0.15*	0.20*	-0.11	0.07												
	G	0.37*	0.64*	0.38*	0.37*	-0.31*	0.06												
Plant height (cm)	P	-0.04	0.19*	-0.03	-0.04	0.28*	0.63*	0.28*											
	G	0.03	0.30*	0.05	-0.1	0.32*	0.76*	0.32*											
Pod length (cm)	P	-0.1	0	-0.18*	-0.26*	0.13*	0.35*	-0.12	0.36*										
	G	-0.06	0.07	-0.21*	-0.47*	0.25*	0.48*	-0.22*	0.46*										
Seeds per pod	P	-0.21*	-0.23*	-0.36*	-0.38*	0.12	0.36*	-0.09	0.27*	0.64*									
	G	-0.39*	-0.35*	-0.54*	-0.71*	0.23*	0.49*	-0.25*	0.39*	0.72*									
Shelling (%)	P	-0.21*	-0.03	-0.23*	-0.20*	0.03	0.13*	0.13*	0.13*	0.1	0.34*								
	G	-0.47*	-0.24*	-0.51*	-0.55*	0.35*	0.13*	0.02	0.28*	0.29*	0.62*								
Pods per plant	P	-0.14*	-0.03	-0.15*	-0.11	0.28*	0.23*	0.08	0.22*	0.03	0.21*	0.29*							
	G	-0.09	0.05	-0.19*	-0.32*	0.46*	0.36*	0.30*	0.28*	0.06	0.35*	0.81*							
Total soluble solids (° brix)	P	0.01	-0.12	0.04	0.03	-0.01	0.05	-0.13*	0.01	0.18*	0.02	-0.02	-0.05						
	G	0.05	-0.36*	0.12	0.14*	-0.25*	0.1	-0.32*	-0.04	0.42*	0.1	-0.12	-0.14*						
Ascorbic acid (mg)	P	0.11	-0.07	0	-0.1	0.12	0.27*	-0.1	0.07	0.12	0.27*	0.06	0.12	-0.04					
	G	0.16*	-0.09	-0.04	-0.25*	0.15*	0.35*	-0.16*	0.1	0.17*	0.38*	0.13*	0.14*	-0.16*					
Total sugars (%)	P	0.03	-0.1	0.01	-0.08	0.13*	0.16*	-0.06	0.12	0.24*	0.15*	0.04	-0.01	0.07	0.09				
	G	-0.05	-0.06	-0.09	-0.15*	-0.02	0.35*	0.00	0.21*	0.50*	0.37*	0.24*	0.13*	0.40*	0.02				
Reducing sugars (%)	P	0.00	-0.07	0.00	0.00	0.14*	-0.09	0.06	-0.19*	-0.06	0	0.13*	0.08	0.04	-0.01	0.11			
	G	-0.01	0.14*	-0.08	-0.31*	-0.1	-0.36*	-0.30*	-0.46*	-0.12	-0.12	-0.11	0.04	-0.08	-0.25*	0.1			
Starch content (%)	P	0.02	0.07	0.01	-0.07	-0.01	-0.09	-0.07	-0.15*	-0.05	-0.01	0.03	0.02	-0.07	0.06	-0.1	0.18*		
	G	0.02	-0.46*	0.01	-0.09	0.17*	-0.21*	-0.29*	-0.31*	-0.13*	0.05	0.01	0.05	-0.01	-0.01	-0.09	0.53*		
Pod yield per plant (g)	P	-0.17*	-0.03	-0.25*	-0.25*	0.31*	0.33*	-0.05	0.28*	0.42*	0.46*	0.25*	0.78*	0.04	0.24*	0.17*	0.14*	0.04	
	G	-0.15*	0.01	-0.35*	-0.63*	0.37*	0.49*	-0.03	0.28*	0.53*	0.66*	0.70*	0.80*	0.1	0.30*	0.37*	0.21*	0.05	

*Significant at P ≤ 0.05

Table 3. Estimates of direct and indirect effects of different traits on pod yield per plant at phenotypic (P) and genotypic (G) levels in garden pea

Traits		Days to first flower	First flower node	Days to 50% flowering	Days to first picking	Number of branches	Internodal length	Nodes per plant	Plant height	Pod length	Seeds per pod	Shelling (%)	Pods per plant	Total soluble solids (°brix)	Ascorbic acid (mg)	Total sugars (%)	Reducing sugars (%)	Starch content (%)	r
Days to first flower	P	**0.035**	0.011	-0.076	-0.006	0.000	0.000	-0.008	0.000	-0.032	-0.011	0.010	-0.106	0.000	0.010	0.002	0.000	0.000	-0.17*
	G	**0.637**	0.282	-1.258	0.635	0.103	-0.056	-0.348	-0.006	-0.068	0.306	-0.269	-0.082	-0.035	0.012	-0.008	0.000	0.007	-0.15*
First flower node	P	0.007	**0.056**	-0.017	0.000	-0.001	0.000	-0.014	0.000	-0.001	-0.013	0.001	-0.025	0.000	-0.006	-0.008	-0.007	0.001	-0.03
	G	0.422	**0.425**	-0.663	0.274	0.007	-0.073	-0.610	-0.057	0.072	0.276	-0.136	0.044	0.255	-0.006	-0.009	-0.002	-0.155	0.01
Days to 50% flowering	P	0.028	0.010	**-0.095**	-0.008	-0.001	-0.001	-0.008	0.000	-0.060	-0.020	0.011	-0.114	0.000	0.000	0.001	0.000	0.000	-0.25*
	G	0.641	0.225	**-1.251**	0.720	0.110	-0.093	-0.362	-0.009	-0.233	0.424	-0.296	-0.167	-0.087	-0.003	-0.015	0.001	0.003	-0.35*
Days to first picking	P	0.013	0.000	-0.050	**-0.016**	0.000	-0.001	-0.011	0.000	-0.087	-0.021	0.010	-0.079	0.000	-0.010	-0.006	-0.001	-0.001	-0.25*
	G	0.537	0.154	-1.195	**0.754**	0.230	-0.174	-0.355	0.019	-0.519	0.556	-0.316	-0.280	-0.096	-0.018	-0.024	0.004	-0.031	-0.63*
Number of branches	P	-0.001	-0.004	0.008	0.001	**0.008**	0.001	0.006	0.000	0.044	0.007	-0.002	0.208	0.000	0.011	0.010	0.015	0.000	0.31*
	G	-0.081	-0.004	0.170	-0.215	**-0.807**	0.173	0.291	-0.062	0.276	-0.177	0.200	0.398	0.177	0.011	-0.003	0.001	0.056	0.37*
Internodal length (cm)	P	-0.003	0.000	0.012	0.002	0.001	**0.004**	-0.004	-0.001	0.115	0.020	-0.006	0.171	0.000	0.026	0.013	-0.010	-0.002	0.33*
	G	-0.057	-0.050	0.188	-0.211	-0.224	**0.622**	-0.059	-0.145	0.530	-0.384	0.073	0.314	-0.067	0.026	0.059	0.005	-0.071	0.49*
Nodes per plant	P	-0.005	0.014	-0.014	-0.003	-0.001	0.000	**-0.056**	0.000	-0.040	-0.005	-0.006	0.058	0.000	-0.009	-0.005	0.007	-0.002	-0.05
	G	0.233	0.273	-0.477	0.282	0.248	0.039	**-0.949**	-0.061	-0.250	0.195	0.010	0.258	0.225	-0.012	0.001	0.004	-0.098	-0.03
Plant height (cm)	P	-0.002	0.011	0.003	0.001	0.002	0.003	-0.015	**-0.002**	0.121	0.015	-0.006	0.161	0.000	0.007	0.009	-0.020	-0.003	0.28*
	G	0.020	0.126	-0.057	-0.075	-0.260	0.472	-0.304	**-0.192**	0.509	-0.303	0.160	0.248	0.025	0.007	0.034	0.006	-0.103	0.28*
Pod length (cm)	P	-0.003	0.000	0.017	0.004	0.001	0.001	0.007	-0.001	**0.334**	0.035	-0.005	0.019	0.000	0.011	0.019	-0.007	-0.001	0.42*
	G	-0.039	0.028	0.261	-0.351	-0.200	0.296	0.214	-0.088	**1.113**	-0.568	0.168	0.055	-0.295	0.012	0.083	0.002	-0.043	0.53*
Seeds per pod	P	-0.007	-0.013	0.034	0.006	0.001	0.002	0.005	0.000	0.213	**0.055**	-0.016	0.158	0.000	0.025	0.012	0.000	0.000	0.46*
	G	-0.248	-0.149	0.677	-0.534	-0.182	0.305	0.236	-0.074	0.806	**-0.784**	0.358	0.302	-0.068	0.028	0.062	0.002	0.018	0.66*
Shelling (%)	P	-0.007	-0.002	0.022	0.003	0.000	0.001	-0.007	0.000	0.032	0.019	**-0.048**	0.216	0.000	0.006	0.003	0.014	0.001	0.25*
	G	-0.297	-0.100	0.640	-0.413	-0.279	0.079	-0.017	-0.053	0.323	-0.487	**0.578**	0.705	0.083	0.010	0.041	0.001	0.005	0.70*
Pods per plant	P	-0.005	-0.002	0.015	0.002	0.002	0.001	-0.004	0.000	0.008	0.012	-0.014	**0.741**	0.000	0.011	-0.001	0.009	0.000	0.78*
	G	-0.059	0.022	0.239	-0.242	-0.367	0.223	-0.280	-0.054	0.070	-0.271	0.465	**0.875**	0.102	0.010	0.021	-0.001	0.018	0.80*
Total soluble solids (°brix)	P	0.000	-0.007	-0.004	-0.001	0.000	0.000	0.007	0.000	0.061	0.001	0.001	-0.034	**-0.001**	-0.003	0.005	0.005	-0.001	0.04
	G	0.032	-0.154	-0.155	0.103	0.203	0.060	0.304	0.007	0.468	-0.076	-0.068	-0.127	**-0.702**	-0.012	0.067	0.001	-0.004	0.10
Ascorbic acid (mg)	P	0.004	-0.004	0.000	0.002	0.001	0.001	0.005	0.000	0.040	0.015	-0.003	0.090	0.000	**0.093**	0.007	-0.001	0.001	0.24*
	G	0.102	-0.037	0.056	-0.186	-0.124	0.218	0.154	-0.019	0.187	-0.298	0.076	0.120	0.113	**0.073**	0.004	0.003	-0.002	0.30*
Total sugars (%)	P	0.001	-0.006	-0.001	0.001	0.001	0.001	0.004	0.000	0.081	0.009	-0.002	-0.006	0.000	0.008	**0.078**	0.012	-0.002	0.17*
	G	-0.032	-0.024	0.111	-0.110	0.012	0.221	-0.004	-0.039	0.554	-0.291	0.141	0.110	-0.281	0.002	**0.166**	-0.001	-0.032	0.37*
Reducing sugars (%)	P	0.000	-0.004	0.000	0.000	0.001	0.000	-0.004	0.000	-0.020	0.000	-0.006	0.059	0.000	-0.001	0.009	**0.107**	0.004	0.14*
	G	-0.007	0.060	0.104	-0.230	0.081	-0.227	0.284	0.088	-0.133	0.095	-0.061	0.031	0.054	-0.018	0.016	**-0.013**	0.176	0.21*
Starch content (%)	P	0.001	0.004	-0.001	0.001	0.000	0.000	0.004	0.000	-0.016	0.000	-0.002	0.016	0.000	0.006	-0.008	0.019	**0.021**	0.04
	G	0.012	-0.196	-0.009	-0.069	-0.134	-0.131	0.277	0.059	-0.142	-0.042	0.008	0.047	0.009	0.000	-0.016	-0.007	**0.336**	0.05

Unexplained variation (P) :0.19; (G) : 0.014

*Significant at P ≤ 0.05; r-correlation coefficient with pod yield per plant; bold values indicate direct effects

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