



P-ISSN: 2349-8528

E-ISSN: 2321-4902

www.chemijournal.com

IJCS 2020; 8(3): 1180-1183

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Received: 15-03-2020

Accepted: 19-04-2020

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International Journal of Chemical Studies

Correlation analysis on different characters in garden pea (*Pisum sativum* var *hortense* L.)

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DOI: <https://doi.org/10.22271/chemi.2020.v8.i3p.9361>

Abstract

A field investigation was carried out at experimental farm of Department of Vegetable Science, College of Horticulture, Mandsaur (MP) to estimate the character association for 17 quantitative traits in 20 diverse genotypes of garden pea during the year 2018-19. The correlation studies revealed that pod yield per hectare exhibited highly significant and positive correlation with pod yield (g/plant), pod yield (q/ha), average pod weight (g), total sugar, T.S.S., number of seeds per pod, protein content, number of leaves per plant, number of pods per plant, pod length (cm), shelling percent, Plant height, number of primary branch per plant and negative association with days to first flower appearance, days to 50% flowering and days to first picking and phenotypic correlation coefficient revealed that the pod yield per hectare showed the maximum significant positive correlation with pod yield (g/plant), pod yield (q/ha), average pod weight (g), total sugar, T.S.S., number of seeds per pod, protein content, number of leaves per plant, number of pods per plant, pod length (cm), shelling percent, Plant height and number of primary branch per plant. Negative association showed with days to first flower appearance, days to 50% flowering and days to first picking.

Keywords: *Pisum sativum* var. *hortense* L., Character association, Quantitative traits, Phenotypic and genotypic correlation

Introduction

Garden pea (*Pisum sativum* var. *Hortense*), belong to family Leguminacea It is one of the most important vegetable crops grown all over the world. In India, it is grown mainly in winter season in plains of north and central parts and as a summer vegetable in the hilly regions of the country. Peas are highly nutritive and high content of digestible protein, carbohydrate, vitamin- C, phosphorus, and minerals. In India, pea is grown in an area of 554 thousand ha with annual production of 5524 million tones having productivity of 10.0 tones per hectare. The major pea growing states are Uttar Pradesh, Madhya Pradesh, Punjab, Himachal Pradesh, West Bengal and Chhattisgarh. In Madhya Pradesh, pea is covering an area of 106.51 thousand ha and 1113.47 thousand million tones production with 10.45 tones/hectare productivity (Anonymous, 2017) ^[1].

Estimates of parameters of variability importantly, heritability and genetic gain are reliable indicators for improvement of characters in a particular genetic material through selection. Since, the selection for highly heritable characters is more effective, therefore, heritability along with other parameters can be used in predicting the gain for a given selection intensity and expected genetic gain further gives the idea of the extent of improvement in a character through simple selection. Moreover, selection for yield and quality traits can be better achieved if the information with respect to correlation between such traits is also available with a better understanding of the association between the relevant characters with yield which is provided through path coefficient analysis (Kumar *et al.*, 2015) ^[8]. The understanding of association of characters is of prime importance in developing an efficient breeding programme. The correlation studies provide information about association between any two characters. The path coefficient analysis provides the partitioning of correlation coefficients into direct and indirect effects giving the relative importance of each of the casual factors (Basaiwala *et al.*, 2013) ^[2]. Therefore the present investigation was conducted to study the association among pod yield contributing traits towards green pod yield in garden pea.

Material and method

The present investigation was carried out during Rabi season of 2018-19 at Vegetable research farm, College of Horticulture, Mandasaur (M.P.). Twenty genotypes of garden pea were collected from College of Horticulture, Mandasaur and local collection from Chhattisgarh and Mandasaur district. The experiment was laid out in randomized block design with three replications. The plants were spaced at 30 cm distance between rows and 10 cm distance between plants with in a row. As per the standard recommendations, all the cultural and agronomic practices were followed and need based plant protection measures were provided in order to maintain a healthy crop stand. Five randomly selected plants were considered for observations of different characters viz., plant height, number of primary branches per plant, number of leaves per plant, number of node of first flowering, days to first flower appearance, days to 50% flowering, days to first picking, number of pods per plant, pod length (cm), average pod weight (g), number of seeds per pod, pod yield per plant, pod yield per hectare, shelling percent, T.S.S. (°Brix), protein content (g/100 g) and sugar content (%). genotypic and phenotypic coefficient of correlation was worked out as per Singh and Choudhary (1977) [15] and formula was given by Johnson *et al.* (1955).

Result and discussion

The knowledge of association among the traits is useful to the breeder for improving efficacy selection. The correlation studies showed that in general estimates of genotypic correlation coefficients were higher than the corresponding phenotypic correlation coefficients, which indicated a strong inherent association among different traits under study. The lower phenotypic values might be due to environmental interactions (Kumawat *et al.*, 2018) [9].

Results indicated the genotypic associations among the different characters of garden pea genotypes are presented in Table 1. Plant height showed high significant positive genotypic correlation coefficient with number of primary branches per plant (0.908**), number of leaves per plant (0.877**), number of node of first flowering (0.982**), number of pods per plant (0.889**), pod length (0.738**), average pod weight (0.937**), number of seeds per pod (0.610**), shelling percent (0.593**), pod yield per plant (0.925**), pod yield per hectare (0.925**), TSS (0.556**), protein content (0.724**), total sugar (0.662**). Similar trend also reported by Lal *et al.* (2011) [10], Singh *et al.* (2011) [14], Tiwari and Lavanya (2012) [20], Basaiwala *et al.* (2013) [2], Katiyar *et al.* (2014) [6], Kumar *et al.* (2015) [8], Pandey *et al.* (2015) [13], Katoch *et al.* (2016) [7], Thakur *et al.* (2016) [19], Devi *et al.* (2017) [3], Gautam *et al.* (2017) [4], Pandey *et al.*

(2017) [13], Toppo *et al.* (2017) [21], Kumawat *et al.* (2018) [9], Lal *et al.* (2018) [11] Singh *et al.* (2018) [11], Srivastava *et al.* (2018) [16], and Singh *et al.* (2019b) [17]. Days to first flower appearance had positive and significant genotypic correlation with days to 50% flowering (0.993**) and days to first picking (0.875**). Similar results were also reported by Katiyar *et al.* (2014) [6], Kumar *et al.* (2015) [8], Pandey *et al.* (2015) [13], Gautam *et al.* (2017) [4] and Kumawat *et al.* (2018) [9].

Results indicated the phenotypic correlation coefficient among the different characters of garden pea genotypes are presented in Table 2. Plant height showed high significant positive phenotypic correlation coefficient with number of primary branches per plant (0.682**), number of leaves per plant (0.459**), number of node of first flowering (0.647**), number of pods per plant (0.720**), pod length (0.571**), average pod weight (0.771**), number of seeds per pod (0.496**), shelling percent (0.402**), pod yield per plant (0.762**), pod yield per hectare (0.762**), TSS (0.388**), protein content (0.456**) and total sugar (0.512**). Similar trend also reported by Lal *et al.* (2011) [11], Singh *et al.* (2011) [14], Tiwari and Lavanya (2012) [20], Basaiwala *et al.* (2013) [2], Katiyar *et al.* (2014) [6], Kumar *et al.* (2015) [8], Pandey *et al.* (2015) [13], Katoch *et al.* (2016) [7], Thakur *et al.* (2016) [19], Devi *et al.* (2017) [3], Gautam *et al.* (2017) [4], Pandey *et al.* (2017) [13], Toppo *et al.* (2017) [21], Kumawat *et al.* (2018) [9], Lal *et al.* (2018) [11] Singh *et al.* (2018) [11], Srivastava *et al.* (2018) [16] and Singh *et al.* (2019b) [17].

Days to first flower appearance was showed positive and significant phenotypic with days to 50% flowering (0.848**) and days to first picking (0.871**). Similar results were also reported by Katiyar *et al.* (2014) [6], Kumar *et al.* (2015) [8], Pandey *et al.* (2015) [13], Gautam *et al.* (2017) [4] and Kumawat *et al.* (2018) [9].

Result obtained in the present investigation with regard to number of node of first flowering showed positive and significant association with number of pods per plant, pod length, average pod weight, number of seeds per pod, shelling percent, pod yield per plant, pod yield per hectare, TSS, protein content, total sugar, plant height, number of primary branches per plant and number of leaves per plant. The results are in close conformity with the findings as reported by Katiyar *et al.* (2014) [6], Kumar *et al.* (2015) [8], Thakur *et al.* (2016) [19], Pandey *et al.* (2017) [13] and Singh *et al.* (2019) [17].

Conclusion

The phenotypic and genotypic association studies revealed that selection of garden pea genotypes should be done based on highly significant correlation at both levels for improvement of garden pea.

Table 1: Estimates of genotypic correlation coefficient between different plant characters in garden pea.

VARIABLE	PH	PB	NL	NOFF	DFFA	50%F	DFP	NP/P	PL	APW	NS/P	SH%	PY/P	PY/Q	TSS	PROTIEN	TS
PH	1.000	0.908**	0.877**	0.982**	-0.854**	-0.888**	-0.738**	0.889**	0.738**	0.937**	0.610**	0.593**	0.925**	0.925**	0.556**	0.724**	0.662**
PB		1.000	0.945**	0.928**	-0.708**	-0.772**	-0.630**	0.837**	0.639**	0.897**	0.597**	0.704**	0.884**	0.884**	0.659**	0.519**	0.478**
NL			1.000	0.583**	-0.734**	-0.792**	-0.712**	0.863**	0.638**	0.858**	0.591**	0.522**	0.870**	0.870**	0.567**	0.416**	0.501**
NOFF				1.000	-0.749**	-0.787**	-0.610**	0.716**	0.837**	0.822**	0.710**	0.743**	0.778**	0.778**	0.582**	0.700**	0.791**
DFFA					1.000	0.993**	0.976**	-0.671**	-0.616**	-0.726**	-0.502**	-0.607**	-0.702**	-0.701**	-0.679**	-0.696**	-0.600**
50%F						1.000	0.875**	-0.724**	-0.742**	-0.788**	-0.602**	-0.678**	-0.766**	-0.766**	-0.789**	-0.727**	-0.699**
DFP							1.000	-0.602**	-0.548**	-0.616**	-0.429**	-0.649**	-0.604**	-0.604**	-0.667**	-0.708**	-0.496**
NP/P								1.000	0.610**	0.961**	0.545**	0.508**	0.985**	0.985**	0.408**	0.433**	0.545**
PL									1.000	0.671**	0.984**	0.789**	0.653**	0.653**	0.612**	0.571**	0.524**
APW										1.000	0.586**	0.559**	0.992**	0.992**	0.476**	0.508**	0.689**
NS/P											1.000	0.736**	0.576**	0.576**	0.520**	0.417**	0.321**
SH%												1.000	0.532**	0.532**	0.769**	0.483**	0.455**
PY/P													1.000	1.000**	0.449**	0.481**	0.627**

PY/Q																			1.000	0.449**	0.481**	0.627**
TSS																				1.000	0.747**	0.547**
PROTIEN																					1.000	0.819**
TS																						1.000

** Level of significant 1 % = (0.285), * Level of significant 5% = (0.2245)

PH= Plant Height, PB= Number of primary branches per plant, NL= Number of leaves per plant, NOFF= Number of node of first flowering, DFFA= days to first flower appearance, 50% F= Days to 50% flowering, NP/P= Number of pods per plant, PL= Pod length (cm), APW= Average pod weight (g), NS/P= Number of seeds per pod, SH%= Shelling percent, PY/P= pod yield per plant, PY/Q= Pod yield per hectare, TSS= Total soluble solid, Protein= Protein content (g/100 g), TS= Total sugar

Table 2: Estimates of phenotypic correlation coefficient between different plant characters in garden pea.

Variable	PH	PB	NL	NOFF	DFFA	50%F	DFP	NP/P	PL	APW	NS/P	SH%	PY/P	PY/Q	TSS	PROTIEN	TS
PH	1.000	0.682**	0.459**	0.647**	-0.666**	-0.614**	-0.573**	0.720**	0.571**	0.771**	0.496**	0.402**	0.762**	0.762**	0.388**	0.456**	0.512**
PB		1.000	0.396**	0.553**	-0.505**	-0.511**	-0.446**	0.586**	0.411**	0.687**	0.400**	0.467**	0.663**	0.663**	0.404**	0.286*	0.341**
NL			1.000	0.381**	-0.535**	-0.500**	-0.479**	0.585**	0.399**	0.592**	0.395**	0.447**	0.603**	0.603**	0.428**	0.174 ^{NS}	0.176 ^{NS}
NOFF				1.000	-0.612**	-0.637**	-0.544**	0.620**	0.613**	0.698**	0.595**	0.553**	0.670**	0.670**	0.470**	0.443**	0.611**
DFFA					1.000	0.848**	0.871**	-0.607**	-0.548**	-0.673**	-0.457**	-0.553**	-0.650**	-0.650**	-0.540**	-0.505**	-0.458**
50%F						1.000	0.795**	-0.609**	-0.592**	-0.683**	-0.532**	-0.534**	-0.664**	-0.664**	-0.577**	-0.561**	-0.521**
DFP							1.000	-0.536**	-0.442**	-0.536**	-0.359**	-0.542**	-0.533**	-0.533**	-0.515**	-0.474**	-0.377**
NP/P								1.000	0.561**	0.930**	0.511**	0.407**	0.970**	0.970**	0.329**	0.340**	0.465**
PL									1.000	0.637**	0.903**	0.668**	0.618**	0.618**	0.467**	0.455**	0.389**
APW										1.000	0.567**	0.493**	0.990**	0.990**	0.403**	0.425**	0.563**
NS/P											1.000	0.630**	0.557**	0.557**	0.433**	0.370**	0.271*
SH%												1.000	0.461**	0.461**	0.602**	0.329*	0.288*
PY/P													1.000	1.000**	0.379**	0.398**	0.523**
PY/Q														1.000	0.379**	0.398**	0.523**
TSS															1.000	0.491**	0.392**
Protién																1.000	0.604**
TS																	1.000

** Level of significant 1 % = (0.285), * Level of significant 5% = (0.2245)

PH= Plant Height, PB= Number of primary branches per plant, NL= Number of leaves per plant, NOFF= Number of node of first flowering, DFFA= days to first flower appearance, 50%F= Days to 50% flowering, NP/P= Number of pods per plant, PL= Pod length (cm), APW= Average pod weight (g), NS/P= Number of seeds per pod, SH%= Shelling percent, PY/P= pod yield per plant, PY/Q= Pod yield per hectare, TSS= Total soluble solid, Protein= Protein content (g/100 g), TS= Total sugar.

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