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Genetic Characterization for Quantitative and Qualitative Traits and Its Relationship in Faba Bean (*Vicia Faba* L.)

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ABSTRACT

An experiment comprising of twenty four diverse Faba bean genotypes were evaluated for genetic variability, correlation and path coefficient analysis for pod yield and its contributing traits. Phenotypic and genotypic coefficient of variation were highest for pod yield per plant (PCV= 55.87% and GCV= 53.90%). Pod yield per plant was significantly and positively correlated with plant height, number of primary branches, pod length, pod width, pod weight and number of pods per plant at genotypic level. Number of pods per plant showed the highest positive direct effect (0.845) on pod yield per plant. Days to fifty per cent flowering, days to first pod picking, plant height, number of primary branches, pod width and number of pods per plant appeared as most important characters and could be considered during selection in Faba bean breeding programmes.

Key words: Correlation, Faba bean, Genetic variability, Path analysis, Yield.

INTRODUCTION

Faba Bean (*Vicia faba* L., 2n=14) is one of the poor man's legume vegetable and third most important pulse crop of the world (Turk and Tawaha, 2002). It is widely used as green or dried vegetable in developing countries and as an animal feed in developed countries (Teshome and Tagegn, 2013). Faba bean is known for its nutritive value, which supplies high proteins (25-40%), dietary fiber, carbohydrates, antioxidants, vitamins and minerals (Nosworthy *et al*., 2018). It is a good source of *levadopa* (*L-dopa*), a precursor of dopamine, can be used in the treatment of Parkinson's disease (Singh *et al*., 2013). In world, total area under Faba Bean is 2.55 million hectares with a production of 4.3 million tons (FAOSTAT, 2012). In India, Faba bean is grown in a limited scale and considered as a minor vegetable due to lack of improved varieties and technologies, however, some locally adapted varieties is mostly cultivated in Uttar Pradesh, Bihar, Rajasthan, Madhya Pradesh, West Bengal and Assam (ICRISAT, 2010).

Knowledge on the nature and the magnitude of genetic variability that exists in the genotypes together with heritability estimates regarding yield and component characters are necessary (Teklu *et al*., 2014) for the maximum and precise effect of selection. High heritability coupled with genetic advance for pods per plant and seed yield per plant signifies that it can be improved through selection programme (Bora *et al*., 1998). Study of character association is very important in breeding as a trait may relate to several other traits. However, correlation coefficient alone may be misleading due to inter-dependence of the component characters among themselves that often influence the direct relationship with yield. To avoid this, path analysis may also be done for explaining the degree of relationship as well that permits the partitioning of the correlation coefficient into direct and indirect effect of traits (Yucel *et al*., 2006) that helps in determining the degree of relationship between yield and its components. Therefore, the present study was undertaken to assess the nature and magnitude of genetic variability, heritability, character associations along with direct and indirect contribution of yield and its contributing traits in Faba bean genotypes.

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MATERIALS AND METHODS

The experiment was conducted at AB Seed Farm of Bidhan Chandra Krishi Viswavidyalaya, Kalyani Simanta, Nadia, West Bengal, India during rabi (November-April) in 2016-17. The farm is situated at 23°N latitude and 89°E longitudes with an average altitude of 9.75 m above from mean sea level. The experimental materials consist of 24 diverse Faba Bean lines which were originated from ICARDA. The name, pedigree and origin of the Faba Bean genotypes used in this study are presented in Table 1. These

24 genotypes were grown in a (RBD) with two replications. All the recommended agronomic package of practices was followed to raise a good crop.

Observations were recorded and averaged to get mean values on five randomly selected plants from each genotype in each replication for yield along with eleven component characters *viz.,* days to 50% flowering, days to 50% pod setting, days to first pod picking, plant height (cm), number of primary branches, pod length (cm), pod width (cm), pod weight (g), number of pods per plant, pod yield per plant (g), number of seeds per pod and 100 dry seeds weight (g). Analysis of variance was carried out as per the procedure given by Panse and Sukhatme (1967). Estimation of genotypic and phenotypic coefficient of variation along with other parameters of variability was done by following Burton and De Vane (1953). The genetic advance (GA) was calculated as per Johnson *et al.* (1955).The phenotypic and genotypic correlation coefficients were computed following Al-Jibouri *et al*. (1958). The path coefficient analysis was done to calculate direct and indirect contribution of different characters towards yield following the method proposed by Dewey and Lu (1959).

RESULTS AND DISCUSSION

Significance of variances and mean performance

The analysis of variance for all the traits indicated highly significant variation among the genotypes (Table 2) which clearly shows that there is presence of sufficient variability in the germplasm. The presence of variability in the genotypes offers an opportunity in improvement of yield and its contributing traits through selection in Faba bean. Likewise, highly significant variations for all the yield related traits were also reported by Alghamdi (2007).

The mean performances obtained for different traits are presented in Table 3. Two genotypes (FLIP15-183FB, FLIP15-196FB) have taken only 47.50 days for fifty percent flowering. While the genotype FLIP15-195FB took 66.50 days for 50% flowering. FLIP15-183FB took 63.50 days to 50% pod setting while first pod picking was done in (75.00 days) which was the earliest from all the other genotypes. The genotype Giza 4 was observed to be late which took 98.00 days for first pod picking. The tallest plants were observed in FLIP15-206FB (109.80 cm) and the shortest ones in FLIP15-195FB (72.10 cm). Regarding pod size, longest pod was recorded in FLIP15-183FB (8.65 cm) and widest pod in FLIP15-201FB (1.73 cm). The maximum pod weight was obtained in FLIP15-201FB (10.15 g) and the least for FLIP15-181FB (4.83 g). The least number of pods per plant was recorded for FLIP15-205FB (7.30) and the most for FLIP15-196FB (26.20). The maximum number of seeds per pod were obtained for FLIP15-199FB (4.05) followed by FLIP15-180FB (3.90) and FLIP15-183FB (3.80). The lowest hundred seed weight was observed for FLIP15-195FB (44.38 g) and the highest for FLIP15-198FB (90.32 g). The highest pod yield per plant was recorded in FLIP15-196FB (201.83 g) followed by FLIP15-201FB (151.77 g) and

Table 1: The pedigree and origin of the twenty four Faba Bean genotypes used in the study.

Genotype	Pedigree	Origin
FLIP15-177FB	S 88096-6-2-32219/TR2010	ICARDA
FLIP15-178FB	S 88134-3-1-1-32221-3/TR2010	ICARDA
FLIP15-179FB	S 88094-8-1-32025-3/TR2010	ICARDA
FLIP15-180FB	Giza 4-32087-1/TR2010	ICARDA
FLIP15-181FB	Giza 4-32127-4/TR2010	ICARDA
FLIP15-182FB	Giza 4-32127-4/TR2010	ICARDA
FLIP15-183FB	S 88082-12-2-1-32192-2/TR2010	ICARDA
FLIP15-188FB	S 88134-3-1-1-32221-2/TR2010	ICARDA
FLIP15-191FB	S 88094-8-2-32334/TR2010	ICARDA
FLIP15-192FB	S 88094-8-2-32334/TR2010	ICARDA
FLIP15-193FB	S 88094-8-2-32334/TR2010	ICARDA
FLIP15-195FB	ILB3315-32125/TR2010	ICARDA
FLIP15-196FB	Selection for heat from Shmabat-Fam SH-6	ICARDA
FLIP15-197FB	Selection from Basabeer-Fam BA-8	ICARDA
FLIP15-198FB	Selection from Hudeiba-Fam Hu-1	ICARDA
FLIP15-199FB	Selection from Hudeiba-Fam Hu-12	ICARDA
FLIP15-200FB	Selection from Hudeiba-Fam Hu-15	ICARDA
FLIP15-201FB	Selection from heat from Shmabat-Fam SH-17	ICARDA
FLIP15-202FB	Selection from heat from Shmabat-Fam SH-24	ICARDA
FLIP15-203FB	Selection from heat from SML-Fam SML-15	ICARDA
FLIP15-204FB	Selection from heat from SML-Fam SML-15	ICARDA
FLIP15-205FB	Selection from Hudeiba-Fam Hu-4	ICARDA
FLIP15-206FB	Selection from Hudeiba-Fam Hu-14	ICARDA
Giza 4	Bulk line	EGYPT

FLIP15-203FB (128.49 g). However, the lowest pod yield per plant was observed in genotype FLIP15-181FB (38.30 g). Faba bean plants vary widely in expression of yield and its contributing traits along with quality parameters that offers opportunities in Faba bean improvement, which were also reported by Kalia and Pathania (2007); Ammar *et al*., (2015).

Parameters of variability

The estimates of phenotypic and genotypic coefficients of variability, heritability (broad sense), genetic advance and genetic gain were statistically worked out to determine the response of selection for different traits, which are presented in Table 2. The perusal of the data showed that phenotypic coefficients of variability (PCV) were higher in magnitude than genotypic coefficients of variability (GCV) for all the characters. The results are in concurrence with Aziz and Osman (2015). Phenotypic coefficient of variation was the highest or pod yield per plant (PCV=55.87%) and lowest for pod width (PCV=8.46%). However, genotypic coefficient of variation was highest for pod yield per plant (GCV=53.90%) followed by number of pods per plant (GCV=40.32%) and pod weight (GCV=21.06%). Least genotypic variance was observed in days to first pod picking (GCV=6.28%). The highest genotypic and phenotypic coefficient of variation was observed for pod yield per plant followed by number of pods per plant and pod weight. It indicates selection can be applied for these traits to identify promising lines. The results are in accordance with the reports made by earlier workers (Saghin, 2002; Kalia, 2003; Pekson, 2007). The differences between PCV and GCV were narrow that signified the importance of genetic variance in the inheritance of the characters (Kumar *et al*., 2017).

Heritability (broad sense) determines to which degree of difference among phenotypes results from genetic causes. Heritability estimates ranged from 40.01% (Pod length) to 93.07% (Pod yield per plant). Pod length had lowest heritability estimates and genetic advance as percent of mean (40.01% and 8.50%). Maximum heritability was recorded for pod yield per plant (93.07%) followed by number of pods per plant (88.43%) and 100 dry seeds weight (86.07%).The broad sense heritability was highest for all the traits recorded. Pod yield per plant followed by 100 dry seeds weight and plant height registered high genetic advance. The characters that exhibit high heritability coupled with high genetic advance could be useful in the selection process as they are controlled by additive genes and less influenced by environment (Panse and Sukhatme, 1985). Low to high heritability were also reported by Kalia and Sood (2004), Alghamdi (2007), Mulualem *et al*. (2013). Some of the characters with high heritability and low genetic advance was observed in this study *viz*., pod length (40.01%, 0.63), number of seeds per pod (41.18%, 0.29), pod width (56.59%, 0.14), number of primary branches (57.44%, 2.06) and pod weight (79.93%, 2.87). This may be accredited to non-additive gene effects and these characters could be improved through hybridisation. High heritability with low

Table 2: Analysis of variance and genetic components for various quantitative traits of exotic Faba bean lines.

Characters	Rep.	Treatment	Error	Mean	Range		CV (%)	PCV (%)	GCV (%)	h^2 (%)	Genetic advance	Genetic advance as % of mean
					Min.	Max.						
Days to 50% flowering	1.688	64.956**	17.035	55.73	47.50	66.50	7.41	11.49	8.78	58.45	7.71	13.83
Days to 50% pod setting	2.521	75.543**	21.477	73.52	63.50	84.00	6.30	9.47	7.07	55.73	8.00	10.88
Days to first pod picking	16.333	92.620**	32.812	87.13	75.00	98.00	6.57	9.09	6.28	47.68	7.78	8.93
Plant height (cm)	34.341	190.562**	54.386	91.92	72.10	109.80	8.02	12.04	8.98	55.59	12.67	13.79
No. of primary branches	1.435	4.785**	1.293	10.47	7.10	14.10	10.86	16.65	12.62	57.44	2.06	19.70
Pod length (cm)	0.293	0.805**	0.345	7.36	6.40	8.65	7.98	10.31	6.52	40.01	0.63	8.50
Pod width (cm)	0.019	0.024**	0.007	1.46	1.25	1.73	6.59	8.46	6.36	56.59	0.14	9.86
Pod weight (g)	0.309	5.465**	0.609	7.40	4.83	10.15	10.55	23.55	21.06	79.93	2.87	38.78
Number of pods per plant	1.470	40.781**	2.503	10.85	7.30	26.20	14.58	42.88	40.32	88.43	8.48	78.11
Number of seeds per pod	0.013	0.169**	0.070	3.33	3.00	4.05	7.97	10.40	6.67	41.18	0.29	8.82
100 dry seeds weight (g)	6.221	321.176**	24.050	70.68	44.38	90.32	7.34	18.44	17.11	86.07	23.29	32.70
Pod yield per plant (g)	97.898	3254.380**	116.846	73.49	38.30	201.83	14.71	55.87	53.90	93.07	78.71	107.11

* Significant at 5 % and ** at 1 % level; No.: Number.

Table 3: Mean performance for different growth and yield traits in 24 exotic lines of Faba bean.

Genotypes	DF	DP	DPP	PH	NPB	PL	PG	PW	NPP	NSP	DSW	PYP
FLIP15-177FB	50.50	68.50	82.00	88.80	8.40	7.98	1.55	9.85	14.10	3.30	63.40	126.95
FLIP15-178FB	61.50	77.00	88.00	87.50	9.50	8.05	1.50	7.18	7.50	3.10	85.01	48.73
FLIP15-179FB	55.50	75.50	91.00	76.50	13.80	7.70	1.55	8.18	9.80	3.00	68.10	69.96
FLIP15-180FB	54.50	72.50	86.00	95.00	10.90	7.08	1.40	6.55	10.40	3.90	59.54	60.82
FLIP15-181FB	59.50	79.00	94.00	86.00	10.20	6.48	1.40	4.83	9.70	3.10	59.10	38.30
FLIP15-182FB	51.50	69.50	83.50	86.00	10.70	7.75	1.43	7.53	7.60	3.30	61.50	49.43
FLIP15-183FB	47.50	63.50	76.00	101.00	7.10	8.65	1.55	9.55	7.70	3.80	86.82	69.00
FLIP15-188FB	66.00	82.50	95.50	81.60	12.50	7.03	1.30	5.30	12.70	3.10	51.47	60.65
FLIP15-191 FB	55.50	72.00	85.00	87.50	11.10	6.73	1.38	6.00	11.40	3.00	56.59	63.18
FLIP15-192 FB	59.00	76.50	90.50	93.30	10.60	7.90	1.50	8.43	7.80	3.10	79.07	61.03
FLIP15-193 FB	52.00	71.00	86.00	80.60	9.30	6.53	1.30	5.80	14.90	3.30	57.75	75.39
FLIP15-195 FB	66.50	84.00	96.50	72.10	10.30	6.80	1.43	7.30	7.90	3.05	44.38	51.20
FLIP15-196 FB	47.50	64.50	76.50	100.70	14.10	7.18	1.55	8.43	26.20	3.20	75.31	201.83
FLIP15-197 FB	49.00	64.00	75.00	97.70	10.10	7.43	1.50	9.33	7.60	3.60	83.16	62.56
FLIP15-198 FB	54.50	74.00	89.00	106.70	9.13	8.33	1.45	10.05	10.90	3.40	90.32	101.68
FLIP15-199 FB	63.50	81.50	95.00	99.10	11.00	6.70	1.30	4.95	10.10	4.05	71.70	44.52
FLIP15-200 FB	49.00	68.00	83.00	106.40	9.60	7.08	1.50	7.08	8.60	3.30	72.30	54.37
FLIP15-201 FB	56.50	76.00	91.50	94.70	10.63	8.00	1.73	10.15	16.00	3.60	81.30	151.77
FLIP15-202 FB	53.50	69.00	80.50	95.10	10.40	7.50	1.55	6.90	7.80	3.30	84.46	48.07
FLIP15-203 FB	57.00	75.00	89.00	100.40	10.80	7.63	1.58	7.40	18.90	3.40	74.97	128.49
FLIP15-204 FB	48.50	65.00	77.50	83.50	9.20	6.40	1.25	6.00	7.60	3.10	62.64	40.64
FLIP15-205 FB	57.00	75.00	88.50	90.60	10.98	7.88	1.50	8.90	7.30	3.00	79.38	59.44
FLIP15-206 FB	60.00	79.00	93.50	109.80	9.30	7.18	1.40	5.68	10.20	3.30	75.66	52.18
Giza 4	62.00	82.00	98.00	85.50	11.73	6.60	1.50	6.25	7.70	3.50	72.45	43.53
C.D. at 5%	8.54	9.59	11.85	15.25	2.35	1.21	0.17	1.61	3.27	0.55	10.73	22.36
SEm±	2.38	2.68	3.31	4.26	0.66	0.39	0.05	0.45	0.91	0.15	2.99	6.24

DF-days to 50% flowering; DP-days to 50% pod setting; DPP- days to first pod picking; PH- Plant height (cm); NPB- number of primary branches; PL- pod length (cm); PG- pod width (cm); PW- pod weight (g); NPP- number of pods per plant, NSP- number of seeds per pod; DSW- 100 dry seeds weight (g); PYP- pod yield per plant (g).

Table 4: Estimates of correlation coefficients at phenotypic (below diagonal) and genotypic (above diagonal) levels for different growth and yield traits in Faba bean.

Characters	DF	DP	DPP	PH	NPB	PL	PG	PW	NPP	NSP	DSW	PYP
DF		0.996**	0.982**	-0.364*	0.371**	-0.342*	-0.274	-0.548**	-0.219	-0.115	-0.470**	-0.408**
DP	0.958**		0.995**	-0.302*	0.392**	-0.275	-0.218	-0.565**	-0.141	-0.070	-0.408**	-0.347*
DPP	0.872**	0.974**		-0.250	0.413**	-0.221	-0.166	-0.579**	-0.097	-0.024	-0.354*	-0.313*
PH	-0.312*	-0.312*	-0.293*		-0.412**	0.453**	0.347*	0.376**	0.163	0.628**	0.640**	0.338*
NPB	0.182	0.205	0.192	-0.180		-0.469**	0.005	-0.187	0.439**	-0.447**	-0.307*	0.292*
PL	-0.188	-0.243	-0.264	0.291*	-0.174		1.143**	1.175**	-0.092	-0.055	0.403**	0.410**
PG	-0.181	-0.153	-0.131	0.226	0.102	0.435**		0.952**	0.298*	0.029	0.449**	0.671**
PW	-0.366*	-0.322*	-0.279	0.163	-0.168	0.632**	0.591**		0.170	0.053	0.408**	0.557**
NPP	-0.181	-0.159	-0.142	0.217	0.370**	-0.001	0.203	0.092		-0.030	0.079	0.910**
NSP	-0.134	-0.134	-0.126	0.412**	-0.149	0.171	0.097	0.097	0.048		0.288*	0.034
DSW	-0.343*	-0.333*	-0.300*	0.517**	-0.151	0.363*	0.308*	0.241	0.107	0.166		0.236
PYP	-0.296*	-0.256	-0.224	0.246	0.236	0.277	0.466**	0.537**	0.878**	0.075	0.190	

*Significant at 5% and ** at 1% level, DF-days to 50% flowering; DP-days to 50% pod setting; DPP- days to first pod picking; PH- Plant height; NPB- number of primary branches; PL- pod length; PG- pod width; PW- pod weight; NPP- number of pods per plant, NSP- number of seeds per pod; DSW- 100 dry seeds weight; PYP- pod yield per plant.

Table 5: Partitioning genotypic correlation into direct (bold) and indirect effects of eleven characters on pod yield per plant in 24 exotic lines of Faba bean.

Characters	DF	DP	DPP	PH	NPB	PL	PG	PW	NPP	NSP	DSW	Genotypic correlation with yield
DF	**0.355**	-1.030	0.700	-0.019	0.013	-0.016	0.032	-0.268	-0.185	-0.002	0.012	-0.408**
DP	0.354	**-1.034**	0.709	-0.016	0.014	-0.013	0.026	-0.276	-0.119	-0.001	0.010	-0.347*
DPP	0.349	-1.029	**0.713**	-0.013	0.015	-0.010	0.020	-0.283	-0.082	0.000	0.009	-0.313*
PH	-0.129	0.313	-0.178	**0.051**	-0.015	0.021	-0.041	0.184	0.137	0.010	-0.016	0.338*
NPB	0.132	-0.405	0.294	-0.021	**0.035**	-0.022	-0.001	-0.091	0.371	-0.007	0.008	0.292*
PL	-0.122	0.284	-0.158	0.023	-0.017	**0.047**	-0.135	0.575	-0.078	-0.001	-0.010	0.410**
PG	-0.097	0.226	-0.118	0.018	0.000	0.054	**-0.118**	0.466	0.252	0.000	-0.011	0.671**
PW	-0.195	0.584	-0.412	0.019	-0.007	0.056	-0.112	**0.489**	0.144	0.001	-0.010	0.557**
NPP	-0.078	0.146	-0.069	0.008	0.015	-0.004	-0.035	0.083	**0.845**	0.000	-0.002	0.910**
NSP	-0.041	0.072	-0.017	0.032	-0.016	-0.003	-0.003	0.026	-0.025	**0.015**	-0.007	0.034
DSW	-0.167	0.422	-0.253	0.033	-0.011	0.019	-0.053	0.199	0.067	0.004	**-0.025**	0.236

Residual factor = 0.006, Bold figures indicate the direct effects,

DF-days to 50% flowering; DP-days to 50% pod setting; DPP- days to first pod picking; PH- Plant height; NPB- number of primary branches; PL- pod length; PG- pod width; PW- pod weight; NPP- number of pods per plant, NSP- number of seeds per pod; DSW- 100 dry seeds weight.

genetic advance for different characters was also reported by Kalia and Pathania (2007).

Correlation studies

The estimates of phenotypic and genotypic correlation coefficients among characters were determined (Table 4). Genotypic correlation coefficients values were higher in magnitude than phenotypic correlation coefficients which may be due to reduction and modification in the inherent associations between the different characters under the influence of the environment. Katiyar and Singh (1990) and Singh *et al*., (2017) also reported that the genotypic correlation coefficient was higher than the phenotypic correlation values for all characters under studied and indicated that genotypic correlation is more dependable than phenotypic correlation and helps to identify the characters to be exploited in breeding activities.

The phenotypic and genotypic correlation coefficients among different characters pointed out that days to 50% flowering was significantly and positively associated with days to 50% pod setting, days to first pod picking and number of primary branches. However, days to 50% flowering was significantly and negatively correlated with plant height, pod length, pod weight, 100 dry seeds weight and pod yield per plant at genotypic level. This result showed that the early maturing genotypes have less yield potential than those of late maturing ones. These findings are in concurrence with Alghamdi and Ali (2004); Alghamdi (2007); Tofiq *et al.,*(2016).

Pod yield per plant was significantly and positively associated with plant height, number of primary branches, pod length, pod width, pod weight and number of pods per plant at genotypic level. At phenotypic level, pod yield per plant was significantly and positively correlated with pod width, pod weight and number of pods per plant only. Number of pods per plant was significant and positively correlated with number of primary branches, pod width and pod yield per plant at the genotypic level. Pod weight was significantly and positively correlated with plant height, pod length, pod width and pod yield per plant at the phenotypic and genotypic levels. These results indicate that selection for number of pods, pod length, pod width, pod weight and seed weight would ensures higher yield as these traits are significantly correlated with pod yield per plant. Significant positive correlations of yield per plant with other horticultural traits in Faba Bean were also reported by Alghamdi (2007); Tofiq *et al.,* (2016). Pod yield per plant, pod weight, 100 dry seeds weight and number of primary branches significantly and negatively associated with days to 50% flowering, days to 50% pod setting and days to first pod picking. Some of the yield components exhibited negative associations with others that might have been due to competition between these components during their development (Adams, 1967).

Path coefficient analysis

Path coefficient analysis at genotypic level used to study the effect of various traits on pod yield per plant. The perusals of phenotypic path coefficient analysis (direct and indirect effects) are presented in Table 5. The direct effect of days to 50% pod setting (-1.034), pod width (-0.118) and 100 dry seeds weight (-0.025) were negative on pod yield per plant which means these traits contributed for its negative correlation with pod yield per plant. Tofiq *et al*., (2016) also reported negative direct effect of100 dry seeds weight on yield. Number of pods per plant showed the highest positive direct effect (0.845) followed by days to first pod picking (0.713), pod weight (0.489), days to 50% flowering (0.355), plant height (0.051), pod length (0.047)number of primary branches (0.035) and number of seeds per pod (0.015) on pod yield per plant. Mridula *et al*., (1992), Ulukan *et al*., (2003) and Tadesse *et al*., (2011) also observed the highest positive direct effect of number of pods per planttogether with plant height and number of seeds per pod on yield. Kumar *et al*. (2017) reported that the number of branches per plant, number of pods per plant, number of seeds per pod and pod length exhibited positive direct effect on yield.

Number of pods per plant also showed high positive indirect effect via number of primary branches and pod width. Kumar *et al*. (2017) also reported the positive indirect effects of number of pods per plant via branches per plant on yield. Singh *et al*. (2017) observed that the positive indirect effects of days to 50% flowering via branches per plant and days to maturity on yield. These results suggest the importance of these traits in selection programme for the improvement of pod yield. The low magnitude of residual effect (0.006) indicated that the traits included in the study accounted for most of the variability present in the dependent variable.

CONCLUSION

It can be concluded from the present investigation that there is a wide range of genetic variability present for all the characters studied. Correlation and path analysis revealed that characters like plant height, number of primary branches, pod length, pod width, pod weight, number of pods per plant and pod yield per plant play a major role and can be used as selection criteria under varietal improvement programme which leads to the development of Faba Bean varieties.

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