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CORRELATION AND PATH COEFFICIENT ANALYSIS IN FABA BEAN (*Vicia faba* L.)

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ABSTRACT

The presented research is conducted at Vegetable Research Farm, Horticulture and Landscape Design, Agriculture and Forestry College, Univ. of Mosul, throughout the autumn growing season of 2018/2019. For studying the correlation and the path coefficient analyses in the faba bean under Mosul conduction, the study contained fifteen (15) genotypes, with three replicated for each genotype under R.C.B.D Design. The resulted showed all the 15 genotypes of Vicia have been significant with regard to all characters, genotype, phenotype have shown significant and positive correlation coefficient between total seed yield for each unit area in the height of plant, amount of branches/plant, weight of pod, amount of pods/plant and hundred seeds weight, while there was positive direct impact of the path coefficient analysis identified regarding total seeds yield with days for flowering, height of plant, weight of pod and the 1000 seeds weight, there was positive and considerable correlation of the total seed yield with plant's height (cm), pods' length (cm), number of branches/plant, 100 seeds weight (gm), also had negative significantly correlation withbiological yield (kg), there was a positive significant coefficient correlation genotypic among the total seeds yield with pod's diameter (cm), plant's height (cm), number of branches/plant, amount of the seeds per pod, pod's length (cm) and diameter of the seed (cm). Furthermore, path coefficient analysis indicated a direct positive effect identified with regard to the total seed yield with days for flowering, plant height, pod weight, and weight of 1000 seeds.

Keywords: Seeds yield; faba bean; path coefficient analysis; genotypic correlation and phenotypic.

INTRODUCTION

Faba bean (*Vicia faba* L.) comes from major significant legume family is the third-largest family [1], legumes seed, also it is specified as one of the excellent sources of minerals, starch, protein and cellulose [2], for human and animals feed in Africa as general and Sudan as specific where, it considers the main meal at breakfast [3], *Vicia faba* L., (2x = 12). Faba bean is grown in all land of Iraq. It is considered as one of the excellent rotation crops with cereals [4], and it must be a significant component regarding the sustainable farming systems. Humans have used this crop for a lot of time as a major protein source, along with its significance as a forage and fodder crop for animals. Faba rich source of protein, minerals, vitamins increased yield and enhanced crop quality [5]. Also, the seed yield for each one of the plants indicated positive and considerable correlations with the plant's height, number of branches per plant, the pods for each plant as well as 100-seed weight. In a similar manner, the correlation of seed yield with either one or more than one trait in Faba bean has also been reported by [6,7]. Turk et al. [8] indicated in their study that the *Vicia faba* L. seed yield was correlated positively with plant's height, biological yield, harvest index, amount of the plants for each square meters, number of seeds and pods/plant.

Path coefficient analyses specified that the high positive direct effect is shown via biological yield as well as harvest index on the seed yield in comparison to other variables. Also, the path analysis in terms of seed yield for each plot specifies that the seed/pod, number of pods/plants, 1000 seed weight, height of the plant, and stand percent indicated a direct, highly positive impact at genotypic, days to maturity, days to flower, along with the number of pods/plants showed direct and positive impact on seed yield for all plots [9].

A research that has been conducted by Singh et al. [10] stated that the major selection standards for enhancing the *Vicia faba* L. seed yield are harvest index and biological yield. In addition, the genotypes of *Vicia faba* L. showed large genetic variability with regard to fiber, protein, and starch content. A study conducted by Ragheb and Solieman [11] indicated the correlations between the following pairs related to total yield in *Vicia faba* L. number of pods/plants, pod's diameter, amount of the branches/plant and the amount of seeds per pods showed desirable as well as positive for the selection criteria in their work. Yet, a negative correlation was indicated for the node number for the 1st pod set with the amount of branches per plant. In addition, a work carried out via Singh et al. [12] specified that significant and positive correlation was indicated by the plan's seeds yield for height of plant succeeded via days of maturity without considerable correlation in terms of the other characters.

The path coefficient analysis specified that the traits which contain the pod's length, 100 seeds wight and the number of branches for each plant are of high importance in seed yield determination regarding *Vicia faba* L. [13]. Sheelamary and Shivani [14] recorded indirect as well as direct effects regarding yield components on seed yield of *Vicia faba* L. A study conducted by Tofiqet al. [15] specified that negative and significant correlations are shown between 100 seeds weight and seed yield, while, positive and considerable correlations are shown between seed yield and the numbers of seed/plant. An extremely significant difference was identified with regard to all the examined traits. The number of clusters for each plant is correlated positively with pods for each plant [16]. The high yield characteristic is affected by the environment, as it is the result of a number of attributes associated with it, so direct selection is not effective in comparison to selection based on other characteristics.

The following objectives were undertaken; evaluating the correlation path coefficient analysis between yield as well as its component traits in the *Vicia faba* L. genotypes within Mosul conditions, Iraq.

METHODS AND MATERIALS

This work is carried out at Vegetable Research Farm, Horticulture and Landscape Design, Agriculture and Forestry College, Univ. of Mosul, throughout autumn growing season in the year 2018/2019 for evaluating the correlation in addition to the path coefficient analyses in *Vicia faba* L. under Mosul conditions, The study contained fifteen (15) genotypes (Table 1). The seed for each genotype was planting on 14/11/2018, each genotype was planting at two lines (3 m for each line) on 20 cm between the seed and 40 cm withen the line under drip irrigation, in a randomized complete block design (RCBD) with 3 replicates for all genotypes. Also, all the genotypes for three replicates take the

Table 1. Line of *Vicia faba* L. genotypes utilized in the presented work

No.	Entry name	Pedigree	Origin
1	S 2009, 140	C08 /Fam392 Ter 10 x B4/9012/06	ICARDA
2	S2009, 56	ILB 1814/L62/96 xSel2007 latt385-2	ICARDA
3	S 2008, 096	R. Blanka (ILB 1270) x WRB1-4	ICARDA
4	S 2009, 116	Jazeari x Sel. 2008 latt 629	ICARDA
5	Aguadulce	ILB 1266	Spain, Icarda
6	S2009,32	Zarazeri xSel2004 latt 217-2	ICARDA
7	S 2009, 81	ILB 4338 x Sel2007 latt374	ICARDA
8	S 2008, 095	WBR 2-7 x WRB 1-4 x local	ICARDA
9	S 2009, 175	ILB 1266-L28/05 x sel.99latt10418	ICARDA
10	S 2008, 034	WRB1-3 x Giza blanca	ICARDA
11	S 2009, 113	ILB 1814 L12/96 x Sel. 2008 latt 629	ICARDA
12	Local Check		ICARDA
13	S 2009, 176	ILB 1814-L1/96 x sel. 99 latt10418	ICARDA
14	S2009,40	ShamixSelllatt 2004 393-2	ICARDA
15	ILB 1814	Syrian Local Large	Syria, ICARDA

same level of fertilizers as 30kg N/ha, 60kg K/ha as K2so4 and 60kg P/ha as P2O5 [17]. The data was recorded on 10 plant for each plot for three replicate via: DF represents the number of days for flowering, Ph represents height of plant (cm), N.B represents the number of branches/plant, BY represents the biological yield (kg), NP represents the number of pods per plant, SN represents the number if seeds per pod, PD represents the diameter of the pod (cm), PL represents the length of the pod (cm), SD represents the diameter of the seed (cm), SL represents the length of the seed (cm), 100SW=100 Seeds weight (gm), SWP=Seeds weight /plant (cm), TSW=Total seeds yield (kg/h). The data were analyzed according to the design with the use of SAS statistical software [18]. The phenotypic in addition to the genotypic correlation between the yield-related traits and seeds yield are evaluated with the use of a technique reported via Miller et al. [19]. With regard to the analysis of indirect and direct effect over the total yield is conducted with path analysis between traits Crus [20].

The correlation between the traits was done according to Walter [21] by using the formula:

$$Rg = \frac{\sigma gx \ X \ \sigma \ gy}{\sqrt{\sigma^2 gx \ X \ \sigma^2 gy}}$$

$$Rp = \frac{\sigma px \ X \ \sigma \ py}{\sqrt{\sigma^2 px \ X \ \sigma^2 py}}$$

RESULTS AND DISCUSSION

Table 2 shows the mean square in ANOVA variance analysis for the studied traits of the genotypes of the faba bean, as it shows that the genotypes reported a significant difference with regard to all the examined traits at a 5% probability level. Table 3 displays the mean values of averages related to studied traits of the studied genotypes, the genotype S2008,095 gave a high value in the trait number of days for flowering it differed significantly from some of the genotypes, while the genotype S009,81 produce the lowest mean for this trait which was 89.00. As for the attribute plant height, the genotype S009, 40 showed the highest values in this trait amounted to (127.00). The genotype S2008.096 gave the lowest value in that which was (94.00). Genetic composition S2009,176 produced the highest reading in an adjective number of branches/plants reached 6.20 and the minimum values appeared with regard to genotype S009,140 as it reached 3.97, while for the characteristic biological yield genetic S2009,113 exceeded some genotypes under-study as it produced the highest value In this trait which reach (1.83), the lowest value produced for this trait was for genotype S2009,116. Genotype S2009,176 produced the highest value in the attribute number of pods/plant was 18.3 while genotype S2008,095 gave the lowest reading in that value to 14.03, The genotype S2009,140 showed the highest reading in that amounted to 5.47, which was differed significantly from some of the genotypes, the genotype S2008,034 gave the lowest reading in that amounted to 4.20, as well as from the same table shown the genotype S2008,034 gave the highest value in pod diameter which was 1.41, while the genotype S2009,176 produced the lowest value was 0.90. As for the trait of pod length(cm), the genotype S2009,81 produced the highest value in that amounted to 11.67 and differed significantly from some of the genotypes under the study, while the genotype S2009,40 gave the lowest value in that amounted to 6.90. It also appears from the same table there have been considerable differences for seed diameter between the studied genotypes, as the genotype S2008,096 outperformed the highest values in that amounted to 1.47(cm) and differed significantly with some of the genotypes, just as the genotype Local check in attribute seed length (cm) over some genotypes. As for the trait of 100 seeds weight (gm), the genotype S2009,175 significantly outperformed this trait with some genotypes where it produced 0.80 (gm) , and the genotype S2008,034 significantly outperformed in the trait of seeds weight per plant over the rest of the genotypes where it produced the highest value in that of 172.30(gm). The genotype S2009,113 produced the lowest value in this amounted to 99.43 (gm), as the genotype S2009,40 outperformed in the attribute total seeds weight (kg/ha.) significantly with some genotypes under-study and produced the highest reading in that 1229.67 while the genotype S2009,56 produced the lowest value in that amounted to 765.00.

Phenotypic correlation coefficients between the various *Vicia faba* L. traits showed in (Table 4), the number of days for flowering indicated a significant and positive correlation with the number of branches for each plant (0.335), significant and negative correlations with seed’s weight for each plant (- 0.232), length of seed (- 0.334), the number of seeds for each one of the pods (- 0.268), the number of pods for each one of the plants (- 0.213) as well as the biological yield (-0.361). The plant’s height indicated significant and positive correlation with the total seed yield (0.222), and negative with 100 seeds weight (- 0.309), length of the pod (- 0.261), and the number of pods/plants (-0.315). Furthermore, the biological yield indicated positive as well as significant correlations with seeds’ weight for each one of the plants (0.304), seed length (0.264) and with the diameter of the pod (0.303), while it showed negative correlation with total seeds yield (- 0.258).

A significant and positive correlations indicated by the number of pods for each one of the plants with the pod’s length (0.233) and number of seeds/pod (256), while the diameter of the pods indicated a positive and considerable correlation with seeds weight for each plant (0.416), seed length (0.480) and pod length (0.514), the length of pod showed significant as well as positive correlations with the (seed’s diameter, seed’s length, weight of the seed for each one of the plants and the total seeds yield, weight of seeds/plant, seed’s length and seed’s diameter) , which were respectively (0.427, 0.386, 0.284 and 0.246). There was significant as well as positive correlations of seed diameter with total seeds yield (0.762) and seed’s length (0.307), and a negative correlation with 100 seeds weight (- 0.446). Seed length indicated a significant and positive correlation via total seeds yield (0.206) and seeds weight per plant (0.651). Whereas, the weight of 100 had significant and negative correlations with total seeds weight (-0.301). These results were consistent with [22,23], with respect to the correlation of phenotypic between the yield of seeds and number of branches per plant and 100 seed’s weight. Alan & Geren [7] relation to the characteristic correlation between the number of seeds with regard to each one of the pods and the number of branches /plant as well as seed yield . The phenotypic association was significantly negative for the date of flowering with the yield and these results were consistent with findings from [24,25,6,26,8,11,15,27].

Table 5 shows the genotypic coefficient correlation among the pairs of the traits studied in the genotypes in the leguminous genotypes, where it appears from the table that the characteristic number of days for lowering has been genetically correlated positively with most of the traits except for traits: pod length, pod diameter and plant height which was negatively correlated. Trait plant height (cm) was also genetically correlated positively with most traits except for length of the pod and the number of seeds for each pod have been genetically related morally negative correlation with it and reached

Table 2. ANOVA table analysis

S.O.V.	D.F	Mean square												
		DF	PH	N. B	BY	NP	SN	PD	PL	SD	SL	100SW	SWP	TSW
Block	2	11.466	299.622	0.656	0.008	1.266	0.098	0.131	3.847	0.122	0.012	0.002	179.936	53604.289
Genotypes	14	45.009**	293.517**	1.268**	0.047*	5.268**	0.363**	0.078*	4.471**	0.099*	0.110*	0.016	1859.299**	33839.032**
Error	28	7.347	39.431	0.283	0.003	0.558	0.095	0.02	0.791	0.046	0.007	0.002	9.338	17436.479
Total	44	63.822	632.57	2.207	0.058	7.092	0.556	0.229	9.109	0.267	0.129	0.020	2048.576	104879.800

DF represents the number of days for flowering, Ph represents the height of plant (cm), N.B represents the number of branches/plant, BY represents the biological yield (kg), NP represents the pods/plant, SN represents the number of seeds/pod, PD represents the diameter of the pod (cm), PL represents the length of the pod (cm), SD represents the diameter of the seed (cm), SL represents the length of the seed (cm), 100SW represents 100 Seeds weight (gm), SWP represents the seeds weight/plant (gm), TSW represents the total seeds yield (kg/h)

Table 3. The mean value regarding all *Vicia faba* L. traits throughout growing season in the year 2018/2019

Genotypes	DF	PH	N.B	BY	NP	SN	PD	PL	SD	SL	100SW	SWP	TSW
1	95.33cde	97.33ef	3.97 e	1.53 c-f	18.30 a	5.47 a	1.01cde	8.70 b-e	1.17abc	1.97efg	0.67cde	130.40 f	958.33bc
2	68.67bcd	111.67bcd	4.50 de	1.67 b	15.40 de	4.63 b-e	1.00cde	7.17ef	0.72 d	2.03def	0.77ab	146.40 d	765.00 c
3	96.67 b-e	94.00 f	4.83cde	1.63bc	17.17ab	4.97abc	1.33ab	10.10 b	1.47 a	2.37 a	0.60ef	127.33f	1018.00ab
4	100.33abc	114.00bc	5.03bcd	1.43 f	15.80bcd	4.30 e	1.21 a-d	8.73 b-e	1.23abc	1.87 g	0.67cde	119.40 g	1051.67ab
5	91.67ef	126.00 a	4.83cde	1.60bcd	15.30 de	4.60 b-e	1.04cde	7.67def	1.31abc	2.40 a	0.53 f	166.47 b	1061.67ab
6	94.67 de	108.00 b-e	5.60abc	1.57 b-e	16.83bc	4.37 de	1.02cde	7.57def	1.21abc	2.07 c-f	0.70bcd	99.80 i	1123.67ab
7	89.00 f	102.33 c-f	4.93cde	1.77 a	17.03ab	5.13ab	1.40 a	11.67 a	1.46ab	2.43 a	0.67cde	170.40ab	1139.67ab
8	104.33 a	103.00 c-f	5.70abc	1.43 f	14.03 e	4.77 b-e	1.12 b-e	9.00bcd	1.22abc	2.10cde	0.63 de	139.77 e	1040.33ab
9	100.33abc	97.00ef	5.87abc	1.57 b-e	14.47 de	4.50cde	1.15 a-e	7.90def	1.12abc	2.17bcd	0.80 a	109.73 h	1006.67ab
10	97.33bcd	102.67 c-f	5.20 a-d	1.80 a	16.83bc	4.20 e	1.41 a	8.20 c-f	1.01 cd	2.30ab	0.77ab	172.30 a	909.33bc
11	96.00cde	116.33ab	5.97ab	1.83 a	15.07 de	4.67 b-e	1.00cde	8.37 c-f	1.11 a-d	1.93fg	0.60ef	99.43 i	1013.00ab
12	96.67 b-e	101.33def	5.83abc	1.50def	15.63 cd	4.50cde	0.95 de	6.90 f	1.05bcd	2.20bc	0.73abc	127.13 f	1044.67ab
13	101.33ab	105.33 b-f	6.20 a	1.53 c-f	18.30 a	4.67 b-e	0.90 e	8.60 b-f	1.16abc	1.97efg	0.60ef	119.17 g	1033.33ab
14	96.33 b-e	127.00 a	6.17 a	1.47ef	14.93 de	4.93 a-d	1.15 a-e	8.10 c-f	1.28abc	2.10cde	0.67cde	109.13 h	1229.67 a
15	100.33abc	108.33 b-e	5.30 a-d	1.57 b-e	15.03 de	4.27 e	1.25abc	9.70bc	1.16abc	2.43 a	0.67cde	157.47 c	1098.33ab

DF= Number of days for flowering, Ph= height of plant (cm), BY=Biological yield (kg), N.B = Number of branches/plant, NP=Number of pods/plant, SN= number of seeds/pod, PD= diameter of the pod (cm), PL=length of the pod (cm), SD=diameter of the seed (cm), SL=length of the seed (cm), 100SW=100 Seeds weight (gm), SWP=Seeds weight /plant (gm), TSW=Total seeds yield (kg/h)

Table 4. Phenotypic correlation for the traits in genotypes *Vicia faba* L. growing season 2018/2019

TR.	COR.	TSW	SWP	100SW	SL	SD	PL	PD	SN	NP	BY	N.B	Ph	DF
DF	rp	-0.130	-0.232*	0.162	-0.334**	-0.153	-0.130	-0.178	-0.268*	-0.213*	-0.361**	0.335**	-0.166	1.000
PH	rp	0.222*	-0.026	-0.309**	-0.089	-0.024	-0.261*	-0.087	-0.119	-0.315**	-0.002	0.175	1.000	
N.B	rp	0.307**	-0.415**	0.062	-0.125	0.022	-0.183	-0.262*	-0.207*	-0.277	-0.100	1.000		
BY	rp	-0.258*	0.304**	0.018	0.264*	-0.099	0.184	0.303	-0.010	0.178	1.000			
NP	rp	-0.062	0.071	-0.124	-0.050	0.176	0.233*	-0.018	0.256*	1.000				
SN	rp	-0.034	-0.019	-0.175	-0.117	0.197	0.233*	-0.098	1.000					
PD	rp	-0.003	0.416**	-0.039	0.480**	0.129	0.514**	1.000						
PL	rp	0.246*	0.284*	-0.290*	0.386**	0.427**	1.000							
SD	rp	0.762**	0.015	-0.446**	0.307**	1.000								
SL	rp	0.206*	0.651**	-0.111	1.000									
100SW	rp	-0.301**	-0.030	1.000										
SWP	rp	-0.163	1.000											

DF represents number of days for flowering, Ph represents height of plant (cm), N.B represents the number of branches/plant, BY represents the biological yield (kg), NP represents the pods/plant, SN represents the number of seeds/pod, PD represents the diameter of the pod (cm), PL represents the length of the pod (cm), SD represents the diameter of the seed (cm), SL represents the length of the seed (cm), 100SW represents 100 Seeds weight (gm), SWP represents the seeds weight/plant (gm), TSW represents the total seeds yield (kg/h)

Table 5. Genotypic correlation for traits in genotypes *Vicia faba* L. growing season 2018/2019

Tr.	Cor.	TSW	SWP	100SW	SL	SD	PL	PD	SN	NP	BY	N.B	Ph	DF
DF	rg	0.422**	0.290*	0.229*	0.456**	0.655**	-0.286*	-0.188	0.447**	0.403**	0.581**	0.347**	-0.218	1.000
PH	rg	0.429**	-0.064	0.411**	-0.162	-0.059	-0.353**	0.366**	-0.249*	0.451**	-0.105	0.230*	1.000	
N.B	rg	0.721**	0.568**	0.039	-0.196	0.011	-0.244*	-0.196	0.533**	-0.421**	-0.205	1.000		
BY	rg	0.435**	0.328**	0.080	0.319**	-0.154	0.258*	0.357**	-0.013	0.174	1.000			
NP	rg	- 0.159	0.056	-0.149	-0.086	0.219*	0.293*	0.032	0.472**	1.000				
SN	rg	0.271*	-0.030	0.415**	0.003	0.651**	0.558**	-0.002	1.000					
PD	rg	0.382**	0.588**	0.308**	0.698**	0.844**	0.817**	1.000						
PL	rg	0.453**	0.393**	0.335**	0.44**	0.9.12	1.000							
SD	rg	0.672**	0.013	0.797**	0.490**	1.000								
SL	rg	0.241*	0.712**	-0.042	1.000									
100SW	rg	- 0.489	-0.012	1.000										
SWP	rg	- 0.317**	1.000											

DF represents number of days for flowering, Ph represents height of plant (cm), N.B represents the number of branches/plant, BY represents the biological yield (kg), NP represents the pods/plant, SN represents the number of seeds/pod, PD represents the diameter of the pod (cm), PL represents the length of the pod (cm), SD represents the diameter of the seed (cm), SL represents the length of the seed (cm), 100SW represents 100Seeds weight (gm), SWP represents the seeds weight/plant (cm), TSW represents the total seeds yield (kg/h)

Table 6. The path coefficients analysis

r1y = -0.4225		r2y = 0.4290		r3y =0.7205		r4y =-0.4348	
direct of x1 on	-0.189	direct of x2on	0.530	direct of x3on	0.635	direct of x4on	-0.276
in direct x2	-0.116	in direct x1	0.041	in direct x1	-0.066	in direct x1	0.110
in direct x3	0.220	in direct x3	0.146	in direct x2	0.122	in direct x2	-0.056
in direct x4	0.160	in direct x4	0.029	in direct x4	0.057	in direct x3	-0.130
in direct x8	-0.016	in direct x8	-0.020	in direct x8	-0.014	in direct x8	0.015
in direct x9	-0.617	in direct x9	-0.056	in direct x9	0.010	in direct x9	-0.144
in direct x11	0.135	in direct x11	-0.241	in direct x11	-0.023	in direct x11	0.047
R8y = 0.4527		**R9y =0.6718**		**R11y = -0.4884**			
direct of x8 on	0.057	direct of x9 on	0.941	direct of x11 on	0.588		
in direct x1	0.054	in direct x1	0.124	in direct x1	-0.043		
in direct x2	-0.187	in direct x2	-0.031	in direct x2	-0.218		
in direct x3	-0.155	in direct x3	0.007	in direct x3	-0.025		
in direct x4	-0.071	in direct x4	0.042	in direct x4	-0.022		
in direct x9	0.952	in direct x8	0.058	in direct x8	-0.019		
in direct x11	-0.197	in direct x11	-0.468	in direct x9	-0.750		

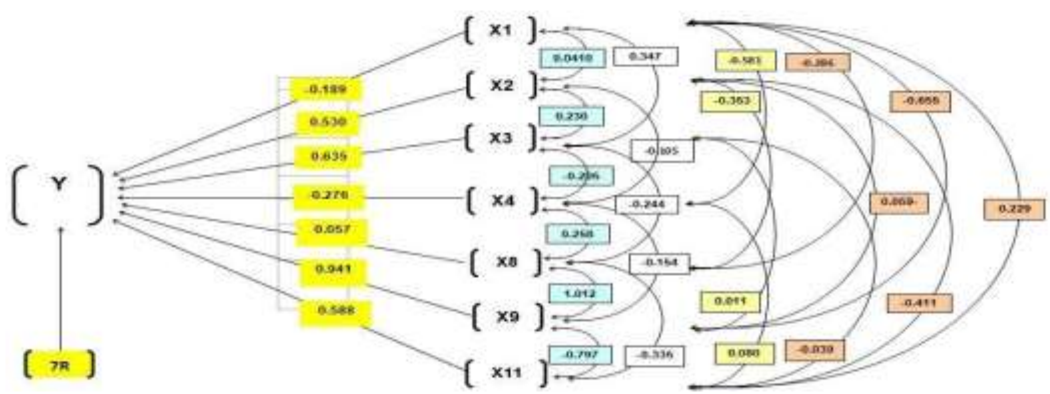

Fig. 1. The path coefficient analysis

(1) DF= Number of days for flowering, (2) Ph= height of plant (cm), (3) N.B = Number of branches/plants, (4) BY=Biological yield (kg), (8) NP=Number of pods/plant (9) 100SW=100 Seeds weight (gm), (11) SWP=Seeds weight /plant (cm), Y=Total seeds yield (kg/h)

(- 0.353 and - 0.249). It also appears from the table that trait number of branch for each one plant was genetically highly correlated with traits total seeds yield, seeds weight for each plant, pod's length, number of pods per plant, and number of seeds for each one of the pods (0.721, 0.568, 0.244, 0.533, 0.421) respectively, Trait biological yield correlated positively genotypic with seeds weight/plant, seed length and pod diameter (0.328, 0.319, and 0.357) respectively. There has been a genetically-positive correlations between the number of seeds for each pod, the diameter of seed (0.219), length of the pod (0.293), number of seeds/pod (0.472). Furthermore, the number of seeds for each pod has been genetically related positively associated with a total seeds yield (0.271), 100 seeds weight (0.415), seed diameter (0.551), and pod length (0.558).

As for as, the trait pod diameter, it entailed a positive genetic correlation with all the studied characteristics. Character pod length was also positive significantly correlated genetically with all studied traits of genotypes of the leguminous population under study. As for attribute seed diameter had genetically related positively correlated with traits total seeds yield (0.672), 100 seeds weight (0.797) and seed length (0.490). From the same table, it appears a positive genetic correlation among trait seed length, total seeds yield (0.241), and seeds weight per plant (0.712). Attributes 100 seeds weight and seeds weight per plant were genetically correlated negatively with attribute total seeds weight as they reached - 0.489 and - 0.317, respectively. These results were consistent with some research [28,13,15,16].

Table 6, and Fig. 1 indicated the path coefficient analysis in genotypes of faba bean under the study, our results showed there was a greatest direct and positive effect on the resultant trait was for the trait of X9 (100SW=100 seeds weight (gm), followed by X3 (number of branches/plant), X11(seeds weight /plant (cm)), and X2 (plant height (cm) its value were (0.941, 0.635, 0.588 and 0.530) respectively. It noted that these traits might be utilized as a selection criterion for high yield [29]. While there was an indirect and positive effect of the trait of X8 (amount of pods/plant), the result through X9(100 seeds weight (gm) with a value of 0.952 and indirect and negative of the trait of X1(number of days for flowering) through X9(100 Seeds weight (gm) of -0.617. These results were consistent with [30,9,13,31,14,16,27] who recorded in their studied indirect and direct effects related to yield components on the seed yield/plant in faba bean.

CONCLUSIONS

This study indicates that all fifteen *Vicia faba* L. genotypes have been important with regard to all characteristics, genotype, phenotype indicating considerable and positive coefficient of correlation between total seed yield for each unit area among plant's height, amount of pods per each plant, amount of branches for each plant, weight of the pod and weight of 100 seeds, path coefficient analysis has been direct positive impact that has been observed for total seeds yield with the day's number for flowering, plant height, the weight of pod and weight 1000 seeds,

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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