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Genetic Diversity in some Faba Bean Landraces Using Morphological Characters and Yield Components

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ABSTRACT

Genetic materials consisted of 42 faba bean (*Vicia faba* L.) landraces and two commercial cultivars (Giza 3 and Sakha 1) maintained at the National Gene Bank in Egypt were sown at El-Gemmeiza Agricultural Research Station in 2015/2016 and 2016/2017 to examine genetic diversity and relationships among landraces of faba bean collected from different regions in Egypt using morphological characters, yield and yield components. Results indicated that landraces No. 13, 16, 20, 21, 23, 28, 29, 32 and 36 are good to improve the performance of seed and seed yield characters through breeding program. Days to 50% flowering had significant and negative correlation with number of tillers/plant and stem intensity of anthocyanin correlation, and days to 50 % flowering had significant and positive correlation with days to 90% maturity, so these morphological characters can be used as a marker assisted selection for early maturity. Seed yield/plant showed positive and significant correlation with each of pods number/plant, seeds number/plant and 100-seed weight. These findings indicated that selection for each or both of No. of pods, seeds and 100-seed weight would be accompanied by high yielding ability. The major contributing traits for the diversity in the first principal component (PC1) were number of seeds per plant, plant height and number of pods per plant. For the second principal component (PC2), 100- seed weight and plant height were major contributors for the diversity. Cluster analysis indicated that maximum similarity was recorded between landraces No. (12 and 27). Minimum similarity was computed between landraces No. (9 and 13).

Keywords: faba bean, landraces, markers assisted selection, correlation, principal component, Cluster analysis.

INTRODUCTION

Faba bean (*Vicia faba* L.) is the most important grain legume in the world (Lopez-Bellido *et al.,* 2005). For decades, this legume represents the only grain legume widely grown in Europe (Gresta *et al.,* 2009). The world production is about 26 millions tons for both green and dry bean in 2008 (FAO, 2008). Because of its high nutritional value and its ability to grow over a wide range of climatic and soil conditions (Bond *et al.,* 1980 and Lawes *et al.,* 1983), the faba bean is the fourth most important crop worldwide (Torres *et al.,* 2010). By cultivation area, it ranks fourth among the cool season food legumes (2.6 millions hectares per year), behind pea, chickpea and lentil. Grown in the Mediterranean zone, the Nile valley, Ethiopia, Central and East Asia, Latin America, Northern Europe, North America and Australia, more than 80% of the cultivation of this legume has been traditionally performed in developing countries (Torres *et al.,* 2010).

Nowadays, its cultivation is continuously declining due to the low yield and yield instability (Gresta *et al.,* 2009). Over the past years, many constraints have combined to limit the production and reduce the growing area of this legume. The yield potentials of existing cultivars are poor, the yields are notoriously variable, predation by pests, diseases and parasites is severe, inputs are limited and production techniques are inefficient (FAO, 2008).

All these constraints caused a negative trend in maintaining the numerous old cultivars present in different growing areas. This caused a strong genetic decline of the local gene pool with the real risk of losing useful genetic resources for future breeding programs and variety development (De Giorgeo and Polignano, 2001).

In the Mediterranean regions, this pool constitutes the basis for plant breeders to develop new cultivars 8 Autochthonous landraces evolved through phenotypic and empirical selection by farmers, it contains genes adaptable to different agro ecological conditions apart from those characteristic of the different regions of Egypt ecosystems.

Marker assisted selection (MAS) has been widely used for major disease resistance genes, selecting alleles with major effects on high value characters with relatively simple inheritance. The advantages of MAS compared to conventional phenotypic selection are the simplicity and reliability of the screening process, which can be performed at early seedling stages, thus saving both time and resources (Torres *et al.,* 2012).

Morphological techniques including cluster analysis, principal components analysis (PCA) and correlation coefficient have been successfully used to classify and measure the pattern of genetic characterization (Sultana and Ghafoor 2006).

Genetic variability present in collection and preserved germplasms are important resource in generating new plant genotypes having desired traits that help to increase crop production and thus improve the level of human nutrition (Singh *et al.* 1991).

Correlation analysis was used widely in many crop species by plant breeders to define the nature of complex interrelationships between yield components and to identify the sources of variation in yield. Knowledge derived in this way can be used to develop selection criteria to improve grain yield in relation to agricultural practices (Finne *et al.,* 2000 and Sinebo, 2002).

Principal component analysis (PCA) is a widely-used tool in analyzing genetic diversity between plant genotypes and determining the most important variables contributing to variation (Price *et al.,* 2006).

The objective of this study was to examine genetic diversity and relationships among 42 genotypes of faba bean collected from different regions in Egypt and two commercial cultivars of faba bean. As well as, use morphological characters as a marker assisted selection to high yield and yield components to help and improve the selection process using that germplasm in breeding programs

MATERIALS AND METHODS

The forty-two faba bean (*Vicia faba* L.) landraces and two cultivars (Giza 3 and Sakha 1) from National Gene Bank of Egypt were sown at El-Gemmeiza Agricultural Research Station in 2015/2016 and 2016/2017. Source of the studied faba bean genotypes is given in Table (1). The seeds were sown in a randomized complete block design (RCBD) with 3 replicates. Seeds were planted in single seeded hills, 20 cm apart. Each genotype was presented by 3 rows, 3 meters long and 60 cm. in between. The morphological identification was measured and recoded using the recommended scales reported by the International Union for Protection of new Varieties (UPOV, 2003) descriptors.

Table 1. Source of the studied faba bean genotypes.

Genotype	Sources	Genotype	Sources	Genotype	Sources
1	New valley	16	Aswan	31	Qena
2	New valley	17	Aswan	32	Sohag
3	New valley	18	Qena	33	Sohag
4	Qena	19	Qena	34	Sohag
5	Qena	20	Qena	35	Sohag
6	Luxor	21	Qena	36	Assiut
7	New valley	22	Qena	37	Assiut
8	New valley	23	Qena	38	Assiut
9	New valley	24	Qena	39	Assiut
10	New valley	25	Qena	40	Assiut
11	New valley	26	Qena	41	Assiut
12	New valley	27	Qena	42	Assiut
13	Aswan	28	Qena	43	Giza 3
14	Aswan	29	Qena	44	Sakha 1
15	Aswan	30	Qena		

Statistical analysis

Simple descriptive statistics (such as means and coefficient of variation) were used in order to compare variation between the studied populations. A variance analysis (ANOVA) was performed and then the averages were compared by least significant difference (LSD) test. Genotypic correlations were computed using variances and co-variances, as suggested by (Johnson *et al.,* 1955). The principal component analysis method explained by (Harman, 1976) was followed in the extraction of the components. Principal Component Analysis was performed using XLSTAT (2014) Software. The statistical analysis and the relationship between the germplasm measured by calculating their Euclidean distance and paired group as phonogram using PAST Paleontological Statistics Version 3.08. (Dryden and Mardia, 1998).

Table 2. A list of scored traits.

Traits	Description	Score	Code
Plant number of stems (tillers more than including half the length of the main stem)	Few Medium Many	3 5 7	PNS
Stem anthocyanin coloration	Absent Present	1 9	SAC
Stem intensity of anthocyanin coloration	Very weak Weak Medium Strong Very strong	1 3 5 7 9	SIAC
Wing: melanin spot	Absent Present	1 9	WMS
Wing: colour of melanin spot	Greenish Brown Blake	1 2 3	WCMS
Standard: anthocyanin coloration	Absent Present	1 9	SAC
Standard: extent of anthocyanin coloration	Small Medium Long	3 5 7	SEAC
Days to 50 % flowering			DF
Days to 90 % maturity			DM
Plant height (cm)			PH
First pod height (cm)			FPH
No. of branches /plant			NB
No. of pods/plant			NP/P
No. of seeds/plant			NS/P
100-seed weight (g.)			100-SW
Seed yield/plant (g.)			SY/P

RESULTS AND DISCUSSION

Morphological characterization

The morphological characterization of the faba bean landraces is summarized as follow (Table,3):

Plant number of stems (PNS): landrace genotype No.7 had many tillers more than including half the length of the main stem as well as two chick cultivars Giza 3 and Sakha 1. Meanwhile the other landraces had few or medium numbers of tillers per plant.

Table 3. Morphological traits of faba bean genotypes under study combined over two seasons.

	PNS	SAC	SIAC	WMS	WCMS	SAC	SEAC
G 1	3	1	1	9	3	9	7
G 2	3	9	3	9	3	9	5
G 3	3	1	1	9	3	9	5
G 4	3	9	7	9	3	9	7
G 5	3	9	5	9	3	9	3
G 6	3	9	7	9	3	1	3
G 7	3	1	1	9	3	9	5
G 8	3	9	3	9	3	9	5
G 9	5	9	3	9	3	9	3
G 10	5	1	1	9	3	9	7
G 11	3	9	7	9	3	9	3
G 12	3	9	5	9	3	9	3
G 13	5	9	3	9	3	1	3
G 14	3	9	7	9	3	9	5
G 15	3	1	1	9	3	9	5
G 16	3	9	3	9	3	1	3
G 17	5	9	3	9	3	9	7
G 18	3	9	3	9	3	9	3
G 19	3	9	3	9	3	9	5
G 20	3	9	5	9	3	9	3
G 21	3	9	3	9	3	9	3
G 22	3	9	3	9	3	9	7
G 23	3	1	1	9	3	9	3
G 24	3	9	7	9	3	9	7
G 25	3	9	3	9	3	1	3
G 26	3	9	3	9	3	9	7
G 27	3	9	3	9	3	9	3
G 28	3	9	7	9	3	9	3
G 29	3	9	7	9	3	9	3
G 30	5	9	3	9	3	9	3
G 31	5	9	5	9	3	9	3
G 32	5	9	3	9	3	1	3
G 33	3	9	7	9	3	9	7
G 34	3	9	3	9	3	9	7
G 35	3	1	1	9	3	9	7
G 36	3	9	3	9	3	9	7
G 37	3	9	3	9	3	1	3
G 38	3	9	3	9	3	1	3
G 39	7	1	1	9	3	9	3
G 40	3	9	7	9	3	1	3
G 41	3	9	5	9	3	1	3
G 42	3	9	5	9	3	9	3
Giza 3	7	9	7	9	3	9	7
Sakha 1	7	9	7	9	3	9	5

Stem anthocyanin coloration (SAC): all landraces genotypes had anthocyanin in their stems as well as the two commercial cultivars Giza 3 and Sakha 1, except landraces No. 1, 3, 7, 10, 15, 23, 35 and 39 had not anthocyanin in their stems.

Stem intensity of anthocyanin coloration (SIAC): Intensity of stem anthocyanin coloration was strong in landraces No. 4, 6, 11, 14, 24, 28, 29, 33 and 40 such as the two chick cultivars Giza 3 and Sakha 1. The other landraces were very weak, weak or medium in this trait.

Wing melanin spot (WMS) and color of melanin spot (WCMS): both landraces and the two chick cultivars had melanin spot in wing with black colour.

Standard anthocyanin coloration (SAC) and Standard extent of anthocyanin coloration (SEAC): SAC was absent and SEAC was weak in faba bean landraces No. 6, 13, 16, 25, 32, 37, 38, 40 and 41. Cultivar Giza 3 and landraces No. 1, 4, 10, 17, ,22, 24, , 26, 33, 34, 35 and 36 had long standard extent of anthocyanin coloration, meanwhile cultivar Sakha 1 and faba bean landraces No. 2, 3, 7, 8, 14, 15 and 19 had medium standard extent of anthocyanin coloration. The other landraces had small standard extent of anthocyanin coloration.

Agronomic, Yield and Yield Components

The results indicated that the studied genotypes differ significantly for all agronomic characters, yield and yield components in combined data over two seasons (Table 4), these results were in agreement with Al Barri and Shtaya (2013) and Sharifi (2014). All landraces were late in flowering (from 54.63 to 67.67 days) as comparing to local cultivars (49.0 and 49.5 days). The same pattern was in maturity all landraces were early (from 137.22 to 143.50 days), meanwhile local cultivars were the same (136.67 and 136.17 days). Most of landraces possessed high mean values for No. of branches /plant (from 2.71 to 5.94) as compared to cultivar Giza 3 (2.67), but landraces No. 7, 9, 15, 38 and 39 had mean values greater than Sakha 1 (2.17) and smaller than Giza 3 cultivar. Landraces No. 17, 18, 27 and 37 possessed high No. of branches, pods and seeds/plant as comparing to the two check cultivars Giza 3 and Sakha 1.

Landraces No. 4, 10, 14 and 34 had also high No. of branches, pods and seeds/plant with low plant height (cm.), meanwhile No. 12 and 26 had high No. of branches, pods and seeds/plant with low height of first pod (cm.).

By comparing between landraces and both cultivars (Giza 3 and Sakha 1) according to yield and yield components (Table 4), the data showed that there were some remarkable landraces such as landraces No. 16, 28, 29, 36 and 23 had high No. of branches, pods, seeds and seed yield /plant, landraces No. 16 and 28 had also low height of first pod (cm.). landraces No. 13 possessed high No. of branches, seeds and seed yield /plant as well as low height of both plant height and first pod height (cm.), meanwhile genotype No. 20 had high No. of branches, pods, seeds and seed yield /plant with low height of plant and first pod (cm.). Landrace No. 21 had high No. of branches, seeds, seed yield /plant and 100-seed weight with low height of first pod (cm.), also genotype No. 32 possessed high No. of branches, pods, seed yield /plant and 100-seed weight with low height of first pod (cm.). The existence of morphological and agronomical diversity among the faba bean populations is further substantiated by principal component analysis, which indicated that the total variation was fairly distributed across all of the agro morphological traits. Assessment of genetic variability between populations is of interest not only for their protection and registration, but also for practical applications conservation of germplasm and breeding purposes (Ouji *et al.,* 2011). So accessions No. 13, 16, 20, 21, 23, 28, 29, 32 and 36 are good to improve the performance of seed and seed yield characters through breeding program.

Relationships among agronomic, yield and yield components.

The information of correlations among characters can be of a great use to breeders, as it points out to the characters to which selection should be directed in order to increase the yield under certain environmental conditions (Kandic *et al.,* 2009). The relationships among traits studied in forty- four faba beans genotypes were estimated by phenotypic correlation coefficients (Table 5). Generally, the success of any breeding programme depends on the extent of genetic variability present on a crop and the knowledge on the correlation between yields and its components characters themselves which can improve the efficiency of selection. Values close to 1 indicate that two variables are behaving almost identically. Conversely, a value close to -1 indicates that two characters are behaving in opposite manner, i.e. when one element is increased the other decreased. A value near 0 indicates that the two elements are independent of each other. In this study, days to 50% flowering had significant and negative correlation with plant number of stems (-0.42^{**}) and stem intensity of anthocyanin correlation (-0.45^{**}), and days to 50 % flowering had significant and positive correlation with days to 90 % maturity (0.48^{**}), so these morphological traits can be used as a marker assisted selection for early maturity. Meanwhile, There was a positive and significant correlation between standard anthocyanin coloration and standard extent of anthocyanin coloration (0.43^{**}). A positive and highly significant correlation was found between No. of seeds/plant with each of No. of pods/plant (0.81^{**}), No. of branches/plant (0.42^{**}) and plant height (0.39^{**}). No. of pods/plant had positive and highly significant correlation with each of plant height (0.46^{**}) and No. of branches/plant (0.49^{**}). Seed yield/plant showed positive and significant correlation with each of No. of pods/plant, No. of seeds/plant and 100-seed weight (0.44^{**}, 0.78^{**} and 0.53^{**}, respectively). These findings indicated that selection for each or both of No. of pods, seeds and 100-seed weight would be accompanied by high yielding ability

The present result agrees with (Kambal, 1969; Berhe *et al.,* 1998 and Ulukran *et al.*, 2003) they study association between seed yield and yield components in faba bean and reported positive significant correlation between seed yield and number of pods per plant. Significant positive correlation was also observed between seed yield and number of seeds per pods (Kambal 1969).

Table 4. Mean performance of faba bean genotypes under study for agronomic, yield and yield components combined two seasons.

Trait Genotype No.	DF (days)	DM (days)	PH (cm.)	FPH (cm.)	NB /P	NP /P	NS /P	100-SW (g.)	SY/P (g.)
1	62.61	139.17	71.04	21.04	3.78	15.96	42.07	54.06	21.82
2	60.85	138.89	76.04	20.83	3.53	13.13	33.79	73.70	24.48
3	64.35	140.00	80.42	21.42	3.35	14.97	43.03	84.58	36.13
4	66.37	137.56	78.33	22.99	4.03	20.67	55.78	50.08	29.28
5	57.35	140.28	89.65	25.49	2.71	16.76	34.97	67.48	24.34
6	54.63	140.45	88.82	22.87	2.97	18.65	48.20	65.46	30.87
7	60.39	138.67	88.03	17.66	2.67	21.13	55.52	50.66	28.21
8	64.70	142.72	85.42	21.67	3.39	16.95	44.75	62.13	27.49
9	61.15	141.89	69.03	19.45	2.28	13.11	27.47	30.91	12.05
10	62.52	141.33	77.99	26.46	3.35	20.53	51.04	59.72	28.94
11	59.17	137.22	84.51	25.56	2.75	17.03	45.60	69.58	30.61
12	59.83	142.22	100.21	19.65	3.67	20.95	52.12	60.29	31.98
13	64.00	137.72	72.78	16.53	3.68	16.15	52.68	71.67	36.97
14	59.17	141.17	83.99	21.88	2.88	22.54	51.58	56.13	28.97
15	60.28	140.22	93.47	26.46	2.17	15.24	43.13	51.98	22.87
16	58.56	141.00	96.53	19.39	3.22	29.46	67.83	53.17	36.31
17	64.83	142.00	89.45	27.92	3.72	20.69	52.03	57.10	29.09
18	63.22	141.22	93.54	25.62	3.18	26.00	60.74	49.19	29.02
19	60.44	140.56	85.07	20.35	3.11	14.90	39.68	72.43	28.83
20	65.17	143.22	82.99	18.06	5.94	26.72	65.46	51.38	33.75
21	60.94	139.78	92.64	16.60	3.18	18.72	57.28	71.04	40.51
22	67.67	143.50	73.89	22.29	5.08	20.97	44.51	50.89	22.38
23	60.28	141.39	94.65	21.32	3.88	26.43	72.11	54.97	38.98
24	58.33	142.00	85.97	20.56	3.00	16.08	38.53	57.41	22.63
25	64.56	142.67	90.28	12.19	3.56	22.31	43.06	49.58	21.28
26	58.89	138.89	87.46	19.10	3.40	20.35	54.18	45.11	25.13
27	61.78	142.78	99.86	23.82	3.39	23.21	53.44	59.64	31.08
28	62.83	143.33	96.04	16.54	2.88	26.54	75.50	71.05	54.11
29	62.83	138.56	87.92	20.83	3.51	20.06	51.35	63.97	34.57
30	59.78	139.78	76.39	21.39	2.72	20.28	46.69	59.92	27.02
31	58.61	140.11	85.14	22.78	2.72	17.65	40.11	52.35	20.66
32	61.28	142.00	103.82	16.88	3.99	21.03	48.44	72.94	33.33
33	58.61	141.06	95.35	34.96	2.90	23.46	35.49	47.85	18.08
34	61.78	140.50	83.54	20.14	2.88	23.97	54.63	56.03	29.98
35	64.89	140.50	88.26	23.54	2.74	16.25	38.21	55.66	20.86
36	61.44	141.17	93.12	22.43	4.90	33.33	62.40	53.53	33.35
37	64.22	141.45	86.60	21.53	3.24	24.22	58.81	51.66	28.56
38	62.11	139.95	80.49	19.10	2.49	17.29	42.54	52.88	22.71
39	61.17	141.61	94.17	23.33	2.31	15.00	39.86	69.38	26.77
40	58.78	139.22	82.92	20.00	2.79	15.88	36.82	63.36	23.47
41	58.83	139.17	88.26	18.96	2.50	20.58	48.65	67.82	31.90
42	60.22	142.89	83.33	23.68	2.68	18.03	43.35	67.12	27.07
Giza 3	49.50	136.67	89.83	25.30	2.67	19.47	49.97	64.92	32.12
Sakha 1	49.00	136.17	84.00	20.67	2.17	14.80	39.35	79.86	31.68
L.S.D 0.05	2.69	1.28	10.66	4.98	1.04	5.91	14.54	8.77	7.52
L.S.D 0.01	3.64	1.73	14.41	6.74	1.40	8.00	19.66	11.86	10.16

DF= Days to 50% flowering, DM= Days to 90% maturity, PH= Plant height (cm), FPH= First pod height (cm), NB/P=No. of branches/plant, NP/P= No. of pods/plant, NS/P= No. of seeds/plant, 100-SW=100-seed weight (g.), SY/P=Seed yield/plant (g.)

Table 5. Phenotypic correlation coefficients among agronomic, yield and yield components of faba bean genotypes under study of combined data over two seasons.

	PNS	SAC	SIAC	SAC	SEAC	DF	DM	PH	FPH	NB/P	NP/P	NS/P	100-SW
PNS													
SAC	-0.06												
SIAC	0.00	0.65**											
SAC	0.06	-0.24	-0.05										
SEAC	0.02	-0.22	-0.09	0.43**									
DF	-0.42**	-0.16	-0.45**	0.01	0.05								
DM	-0.28	0.04	-0.22	0.03	-0.14	0.48**							
PH	-0.08	0.04	0.07	-0.08	-0.23	-0.20	0.28						
FPH	0.10	-0.14	0.12	0.41**	0.38*	-0.15	-0.04	0.08					
NB/P	-0.27	0.12	-0.10	0.05	0.17	0.52	0.34*	-0.04	-0.17				
NP/P	-0.27	0.19	0.03	-0.08	-0.01	0.17	0.36*	0.46**	-0.03	0.49**			
NS/P	-0.21	0.03	-0.04	-0.05	-0.13	0.19	0.17	0.39**	-0.24	0.42**	0.81**		
100-SW	0.21	-0.02	0.15	-0.06	-0.20	-0.26	-0.28	0.11	-0.11	-0.14	-0.32*	-0.07	
SY/P	-0.03	0.05	0.13	-0.05	-0.26	-0.01	-0.01	0.38*	-0.31	0.22	0.44**	0.78**	0.53**

***, ** significant at P< 0.05 and 0.01, respectively.**

Principal components analysis

In order to describe and gain a better understanding of variance sources among faba bean populations, Principal Components Analysis (PCA) was carried out. Principal components analysis shows the significance of the major contributor to the total variation in each dimension of differentiation. The eigen values help to identifying the number of factors to be retained. Therefore, in this analysis the first factor retains the information contained in 140.28 of the original variables (Table 6). The PC1 explained for about 43.056 of the variation in seed yield per plant; PC2 for 33.522 and PC3 for 14.287. The major contributing traits for the diversity in the first principal component (PC1) were number of seeds per plant, plant height and number of pods per plant. For second principal component (PC2), 100- seed weight and plant height were major contributors for the diversity. The third principal component (PC3) plant height and first pod height. Principal Components Analysis was constructed by using seven yield traits, showed the number of pods per plant, number of ovules and seeds per pod, and branching from the basal nodes to be the most important traits for population evaluation regarding yield (Terzopoulos *et al.,* 2003).

Table 6. Loadings of PCA for the estimated traits of faba bean genotypes under study at combined date over two seasons.

	PC 1	PC 2	PC 3
DF	0.058	-0.103	-0.187
DM	0.048	-0.035	0.053
PH	0.376	0.283	0.838
FPH	-0.047	-0.047	0.219
NB/P	0.026	-0.007	-0.037
NP/P	0.337	-0.041	0.013
NS/P	0.825	0.161	-0.418
100-SW	-0.235	0.937	-0.189
Eigen value	140.953	109.742	46.772
Variability (%)	43.056	33.522	14.287

PC= principal component

Clustering based on morphological, agronomic, yield and yield components.

Cluster analysis for investigated traits showed diversity among investigated faba beans genotypes. All genotypes are divided into two groups. The first group contains landraces No. 9. The second group contains other landraces collected from different regions. Number of seeds per plant, 100 – seed weight and seed yield per plant are valuable in splitting the studied genotypes into two groups. landrace No. 9 had low value in these traits.

The second group was divided into two sub-groups . The remaining landraces of 13, 2, 3 and Sakha 1 delimited in a separate sub-group, while other landraces were separated in the other sub-group. Maximum similarity was recorded between landraces (12 and 27). Minimum similarity was computed between landraces (9 and 13).

Similar results were reported by (Arab *et al* 2013), who studied some Egyptian faba bean landraces collected from different areas by using morphological traits .

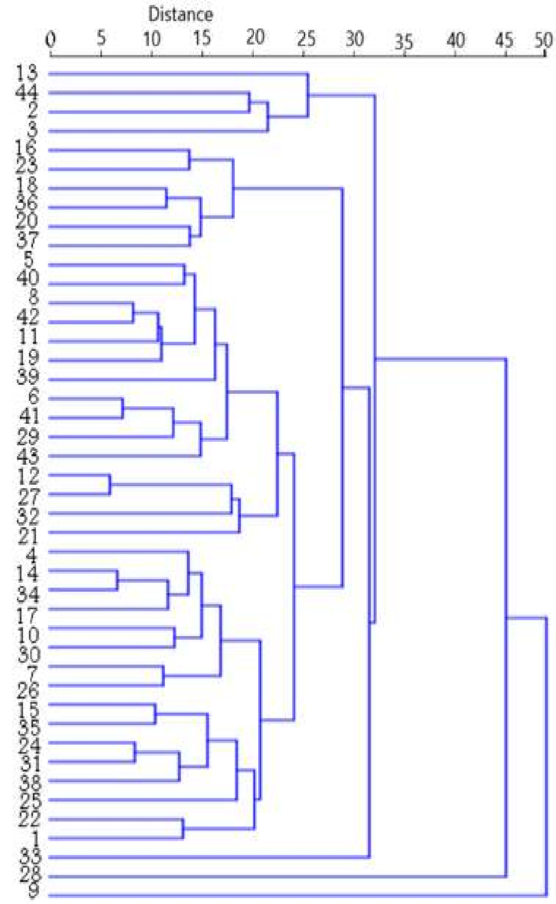

Fig. 1. Phenogram showing the relationships between 44 genotypes of faba bean, using distance metric of 1- Euclidean correlation coefficient and average linkage method.

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التنوع الوراثى في بعض السلالات البرية في الفول البلدي باستخدام الصفات المورفولوجية والمحصولية

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اجري هذا البحث باستخدام 42 من السلالات البرية المجمعة من مناطق مختلفة من مصر والمحفوظة بالبنك القومي للجينات بالإضافة لإثنين من الأصناف التجارية (جيزة 3 و سخا1). تم التقييم بمحطة بحوث الجميزة خلال موسمي 2015 /2016 و 2016/ 2017 باستخدام تصميم القطاعات الكاملة في ثلاث مكررات بهدف دراسة التنوع الوراثي بين هذه السلالات البرية المجمعة باستخدام ستة عشر صفة من الصفات المورفولوجية والمحصولية. أظهرت الدارسة أن السلالات البرية أرقام 16،13، 20، 21، 23 ،28 ،29 ،32 ، 36 يمكن الاستفادة منها في برامج تربية الفول البلدي. كان هناك إرتباط معنوى وسالب بين عدد الأيام من الزراعة وحتى تزهير 50% من النباتات مع عدد السيقان فى النبات وكذلك مع كثافة صبغة الانثوسيانين علي الساق كما أن عدد الايام من الزراعة وحتى تزهير 50% من النباتات ترتبط بعدد الأيام من الزراعه وحتى نضج 90% من النباتات ارتباط معنوى وموجب ، لذا يمكن إستخدام هذه الصفات المورفولوجية كمعلمات للانتخاب لصفة التبكير فى النضج. أظهر محصول البذور/ النبات إرتباط معنى وموجب مع عدد القرون / النبات و عدد البذور / النبات ، وزن 100 بذرة. هذه النتائج توضح أن الانتخاب لكلا″ من عدد القرون و عدد البذور و وزن 100- بذرة مرتبط بالقدرة على انتاج محصول مرتفع من البذور. اظهرت نتائج تحليل المكونات الرئيسية أن المكون الرئيسي الأول يشمل كلا″ من صفات عدد البذور/ نبات وطول النبات و عدد القرون / نبات وبالنسبة للمكون الرئيسي الثاني يشتمل علي كلا″ من صفة وزن 100 بذرة وطول النبات. كما أظهرت نتائج التحليل العنقودي أن التراكيب الوراثية كانت ذات تنوع وراثي كبير وأن السلالات البرية أرقام (12 و 27) هي الأعلي في درجة التقارب الوراثي و السلالات البرية أرقام (9 و 13) هي الأقل في درجة التقارب الوراثي.