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V. SUMMARY

The main objectives of the present investigation was to study the inheritance of some quantitative traits in faba bean as well as evaluation of some new promising inbred lines by using factorial mating design analysis (lines x testers analysis). Nine genotypes of faba bean (*Vicia faba* L.) were used as parents. They were included two groups according to the growth habits, first group, four indeterminate cultivars (Giza 461, Giza 843, Sakha 1 and Nubaria 1) were used as females and second group, five lines (D_5, D_6, D_7, D_8 and D_9) were used as males. In 1999/2000 season, the parental genotypes were sown under the insect free plot in three successive planting dates to secure synchronism of flowering periods for parental genotypes. Twenty crosses were made between determinate and indeterminate genotypes in a factorial mating design without reciprocals (female by male). In 2000/2001 season, the F_1 plants of twenty successful crosses were grown and the harvested seeds furnished F_2 seeds throw selfing. The same crosses repeated to produce more F_1 seeds. In 2001/2002 season, two adjacent experiments were conducted, the first involved the nine parental genotypes and their 20 F_1 generation, the second involved the nine parental genotypes and their 20 F_2 generation. Both experiments were grown in a Randomized Complete Block Design with four replications. The experimental plot consisted of one, one and three ridges for each parent, F_1 and F_2 generation respectively. Each ridge was two meters long and 60 cm apart and 20 cm between hills on one side of the ridge and single seed per hill. In each replication, data were recorded on 10 guarded plants in each plot for both parents, F_1 generation and 30 guarded plants in F_2 generation. In both experiments, data were recorded on the following traits: days to first flowering, days to maturity, plant height, first pod height, no. of branches/plant, no. of pods/plant, no. of seeds/plant, no. of seeds/pod, seed yield/plant and 100-seed weight in addition evaluation of the parent and some F_1 crosses through isozyme and protein analysis. Analysis of variance was carried out in each experiment. When differences among top crosses were significant, line x tester analysis according to **Kempthorne (1957)** was practiced for each experiment. Genetic parameters were estimated according to

Comstock and Robinson (1952). Heritability values in broad and narrow senses were estimated for all traits. Heterosis percentage for individual crosses relative to mid and better parent, inbreeding depression, expected gain from selection and percentage gain of selection were estimated for all studied traits. The results of the present study could be summarized as follows :

1. Inheritance of determinate growth trait was recessive for the F_1 but in the F_2 generation segregated plants were three indeterminate to one determinate.
2. The values of mean performance for all traits in the F_1 generation are found to be more than their corresponding values in the F_2 generation except for days to maturity and no. of branches. The same result was relative to experimental error variance except for first pod height, seed yield/plant and 100-seed weight. All studied traits in F_1 generation showed the highest values of (C.V. %) more than their corresponding values in the F_2 generation except for first pod height, no. of pods, seed yield/plant and 100-seed weight.
3. The genotype mean squares and its components were significant for all studied traits except a few cases in both generations.
4. The best heterosis value for earliness was detected in the cross Giza 461 x D_6 relative to mid parents. The best heterosis value for plant height was detected in the cross Giza 461 x D_5 relative to better parents. All the crosses showed highly significant positive values relative to both mid and better parents for seed yield/plant, the best heterosis values were detected in the crosses Giza 843 x D_8 (194.7 %), Sakha 1 x D_7 (178.5 %), Sakha 1 x D_8 (153.6 %), Sakha 1 x D5 (149.1 %), Giza 843 x D_7 (141.7 %) and Sakha 1 x D_9 (135.3 %) relative to mid parent. While, the best heterosis values were detected in the crosses Sakha 1 x D_5 (143.9%), Giza 843 x D_8 (124.6%) and Giza 461 x D_5 (116.04%).
5. Significant positive and negative inbreeding depression was observed for most of the crosses for all studied traits.

6. The late variety Giza 461 was a good combiner for no. of pods and seed yield/plant, the late variety Nubaria 1 was a good combiner for no. of branches, seed yield/plant , no. of seeds/pod and 100-seed weight. While, Giza 843 and Sakha 1 were a good combiners for earliness, plant height, first pod height, no. of pods/plant and no. of seeds/plant. On the other side, the late male genotypes D_5 was a good combiner for plant height, first pod height, no. of seeds/plant, seed yield and 100-seed weight, but D_6 was a good combiner for no. of pods and seeds/plant and D_8 was a good combiner for earliness, no. of branches/plant and 100-seed weight, the earlier male genotype D_9 was a good combiner for earliness, plant height, first pod height and no. of branches/plant and no. of pods/plant.
7. Regarding to F_2 generation the late variety Giza 461 was a good combiner for no. of pods. However, the late variety Nubaria 1 was a good combiner for no. of branches, seed yield/plant and 100-seed weight. While both the early maturity varieties Giza 843 and Sakha 1 were a good combiners for earliness. On the other hand, the late male genotypes D_5 and D_6 were a good combiner for plant height, no. of seeds and seed yield/plant. Moreover, D_8 and D_9 were a good combiners for no. of branches/plant, plant height, first pod height, 100-seed weight and earliness.
8. In F_1 generation the most desirable for SCA effects for earliness, no. of seeds/plant, seed yield/plant and no. of seeds/pod were detected in the cross Nubaria 1 x D_7. While for plant height was detected in the crosses Giza 461 x D_5, Giza 843 x D_5 and Nubaria 1 x D_9. However for first pod height was detected in the crosses Giza 843 x D_6, Sakha 1 x D_7 and Nubaria 1 x D_9. While for no. of branches/plant was detected in the crosses Giza 461 x D_9, Giza 843 x D_6 and Sakha 1 x D_7. On the other hand for no. of pods was detected in the crosses Giza 843 x D_6, Giza 843 x D_9, Sakha 1 x D_7 and Sakha 1 x D_9. For no. of seeds/plant was detected in the crosses Giza 461 x D_5, Giza 461 x D_8, Giza 843 x D_6, Giza 843 x D_9, Sakha 1 x D_5, Sakha 1 x D_7 and Nubaria 1 x D_7. Moreover, for seed yield were detected in the crosses Giza 461 x D_5, Giza 843 x D_6, Sakha 1 x D_5,

Sakha 1 x D_7, Nubaria 1 x D_7 and Nubaria 1 x D_8. While for 100-seed weight were detected in the crosses Giza 461 x D_9, Giza 843 x D_7, Sakha 1 x D_9 and Nubaria x D_5.

9. In the F_2 generation, the most promising crosses which had desirable values of SCA effects were as follows: for flowering and maturity crosses, Giza 461 x D_9, Giza 843 x D_7, Sakha 1 x D_6 and Nubaria 1 x D_5. While, for plant height and first pod height crosses; Giza 461 x D_8, Giza 843 x D_6, Sakha 1 x D_6, Sakha 1 x D_8 and Nubaria 1 x D_8. The cross Sakha 1 x D_6 for no. of branches, however, for no. of pods/plant, the crosses; Giza 461 x D_6 and Giza 461 x D_8; for no. of seeds/plant , the crosses; Giza 843 x D_8, Nubaria 1 x D_5 and Nubaria 1 x D_6, for seed yield/plant, the crosses; Giza 461 x D_8 and Nubaria 1 x D_6.
10. In the F_1 generation, the highest contribution values were referred to female effect for all studied traits except for no. of seeds/pod, while the contribution values of males were higher than females x males for all studied traits except for no. of branches/plant, no. of pods, no. of seeds/plant and 100-seed weight. Regarding to F_2 generation, highest contribution values were referred to females effect for all traits except days to flowering, maturity, no. of branches and no. of seeds/plant. While the contribution values of males were higher than males x females for all traits except for no. of pods/plant, no. of seeds/pod, seed yield and 100-seed weight.
11. The additive (σ^2 A) genetic variance was larger than non-additive genetic variance (σ^2 D) for all studied traits in both F_1 and F_2 generation except for no. of seeds/plant was less in F_1 and F_2 and for no. of pods/plant was less in F_2. Such results indicated that the additive genetic variance played an important role in the inheritance of these traits.
12. Dominance degree ratios were less than unit for all studied traits in both F_1 and F_2 generation except for no. of seeds/plant in F_1 was higher than unit indicating the importance of additive genetic variance for all traits, respectively.

13. Broad sense heritability (h^2_b %) estimates were larger than the corresponding values of narrow sense heritability (h^2_n %) for all studied traits in both two generations except for 100-seed weight in F_2 generation. Heritability in broad sense ranged from 54.5% for no. of seeds/pod to 96.3% for first pod height, in the F_1 generation, but, in the F_2 generation ranged from 46.9% for 100-seed weight to 96.1% for days to flowering. Heritability in narrow sense ranged from 44.6% for no. of seeds/plant to 93.3% for days to flowering in the F_1 generation while ranged from 27.9% for no. of pods/plant to 89.2% for days to flowering in the F_2 generation.
14. The expected genetic advance (GA) in F_2 generation was observed for all studied traits ranged from 1.2 for no. of branches/plant to 20.2 for plant height. While the predicted genetic advance (GA %) was observed ranged from 2.3% for days to maturity to 38.1% for days to flowering.
15. The analysis of seed protein for all parents (determinate and indeterminate habit types), by SDS-PAGE revealed that presence thirty two bands with mobility and molecular weight were different. The band no. 4 with mobility Rf= 0.20, Mw= 107 kd revealed as a genetic marker to differentiate between each of indeterminate and determinate habit of faba bean, whereas, revealed faint density for all indeterminate habit parents, while, revealed absent to very faint for all determinate habit parents.
16. The analysis of the peroxidase and esterase isozymes for all parents (determinate and indeterminate habit types) revealed that no differences between each of two types of faba bean .
17. The analysis of seed protein and isozymes (peroxidase & esterase) for some parents with some of their F_1 hybrids confirmed that moving some of bands from male parents to their descendants.
18. The investigator concluded that the promising determinate lines obtained from this investigation could be planted in the newly reclaimed areas as Toshki and Aowinat to make use of the advantages of these determinate lines such as drought resistance, low water requirements and tolerance to unsuitable environmental factors.