ENGLISH SUMMARY

This study was carried out at the Experimental Station of Faculty of Agriculture, Moshtohor, Zagazig University during the four successive winter seasons; 1997/1998, 1998/1999, 1999/2000 and 2000/2001.

The main goal of breeding faba bean *(Vicia faba L.)* is to produce new genotypes improved in one or more necessary feature such as protein quality and quantity beside some other economical characters.

The study includes treating seeds of six cultivars of faba bean (Giza402, Giza2, Giza3, FAB 3337/78, FAB 89/74 and FAB 114/80) with chemical mutagen Ethylmethane Sulphonate (EMS).The seeds of the six cultivars are treated with four concentrations of EMS; 0.1%,0.2%,0.3% and 0.4%.The seeds of six varieties of faba bean were grown in complete randomized block design experiment for each mutagen .Data were obtained on the M_1 plants,M_2 and selected mutants from the seeds of M_3 generation.

The Study Was Classified into Three Main Parts:

I. Effect of Ethylmethane Sulphonate (EMS) on Some Economical Characters of Faba Bean *(Vicia faba L.)*.

II. **Effect of Ethylmethane Sulphonate on Some Biochemical Characters in Faba Bean** *(Vicia faba L.)*.

III. DNA MARKERS For Identification of Faba Bean *(Vicia faba L.)* **Quality Characters.**

I. Effect of Ethylmethane Sulphonate (EMS) on Some Economical Characters of Faba Bean *(Vicia faba L.)*:

The nature and amount of variability induced after EMS treatments for faba bean (Giza 402, Giza 2, Giza 3, FAB-337/78, FAB-89/74 and FAB-114/80) in different economical yield characters and seed characters were analyzed quantitatively to assess the extent of induced variations. The data on the effect of various concentrations of EMS on the mean values and variances of the different economic characters in M_2 and M_3 generations would be discussed as the following:

- **Giza402:**

The different economic characters in M_2 and M_3 generations were high significantly at all concentration levels as compared to control. It was found that very high significant increase in the heretability percentages in case of number of pods per plant at 0.1 concentration, number of seeds per pod at 0.2 % concentration, number of leaflets per leaf at all concentrations especially at 0.4%, 100 seed weight per plant at 0.2 and 0.3% concentrations, and the yield weight per plant at all concentrations especially at 0.2 % concentration.

- **Giza2:**

The different economic characters in M_2 and M_3 generations were high significantly at all concentration levels as compared to control. It was high that significant increase in the heretability percentages in case of plant height at 0.1 concentration), number of branches per, height of first pod at 0.1 % concentration and at 0.3 % concentration, number of pods per plant at all concentrations especially at 0.4 % concentration, number of seeds per pod at all concentrations especially at 0.1 % concentration, 100 seed weight per plant at all concentrations and the yield weight per plant at all concentrations especially at 0.4 % concentration.

- **Giza3:**

The different economic characters in M_2 and M_3 generations were high significantly at all concentration levels as compared to control. It was found that high significant increase in the heretability percentages in case of plant height at 0.3 % concentration, number of branches per plant, height of first pod at 0.3 % and 0.4 % concentration, number of pods per plant at 0.1 %, 0.2 % and 0.3 % concentration), number of seeds per pod (at concentrations 0.2 %, 0.3 % and 0.4 %, number of leaflets per leaf at all the concentrations,100 seed weight per plant at 0.3 % and 0.4 % concentrations and the yield weight per plant at all concentrations especially at 0.1 concentration.

- **FAB 337/78:**

The different economic characters in M_2 and M_3 generations were high significantly at all concentration levels as compared to control. It was found that high significant increase in the heretability percentages in case of plant height at 0.1 and 0.2% concentration, number of branches per plant at 0.1 %, 0.3 and 0.4 % concentrations, height of first pod was highly and improvement, number of pods per plant at all concentrations and especially at 0.3 % concentration, 100 seed weight per plant and the yield weight per plant were better than local variety (Giza 402 , Giza2 and Giza3) at all concentrations especially at 0.1 , 0.2 and 0.3 %.

- **FAB 89/74:**

The different economic characters in M_2 and M_3 generations were high significantly at all concentration levels as compared to control. It was found that high significant increase in the heretability percentages in case of plant height were medium and high at 0.2, 0.3 and 0.4% concentration, number of branches per plant was highly heretability percentages in all concentrations, height of first pod at 0.1, 0.3 and 0.4% concentration, number of pods per plant in all concentrations was

highly and nearly, 100 seed weight per plant at all concentrations especially at 0.3 %, and 0.4% and the yield weight per plant had high heretability% in all concentration.

- **FAB 114/80:**

The different economic characters in M_2 and M_3 generations were high significantly at all concentration levels as compared to control. It was found that high significant increase in the heretability percentages was nearly in case of plant height in all concentrations, number of branches per plant at 0.1 % and 0.3 % concentrations, height of first pod at 0.1 % concentration and 0.3 % concentrations, number of pods per plant the heretability percentages was nearly medium in all concentrations, 100 seed weight per plant at all concentrations especially at 0.1 %, and in cases the yield weight per plant the heretability percentages was nearly with at 0.1 %, 0.3 % and at 0.4 % concentrations, but especially at 0.1%in the M_3 generation in comparison to control.

****Concerning the seed size characters of faba bean genotypes it was found that highly significant differences between the six varieties under study in seed length, width, thickness and indices of seeds (Length / Width) and (Width / Length).**

It was selected some mutant lines in M_3 population that was highly in quality characters. It was found that the high degree of genetic stability in all local varieties (Giza-402, Giza-2 and Giza-3) and introduced varieties (FAB 337/78 , FAB 89/74 and FAB 114/80), also the mutant lines were entered in screening and selection programs by corresponding between economical characters and Biochemical characters i.e. percentage of protein content, percentage of soluble protein and percentage of available protein % and trypsin inhibitor content .

II. Effect of Ethylmethane Sulphonate on Some Biochemical Characters in Faba Bean *(Vicia faba L.)* :

II.1 The improvement of Protein contents and Trypsin Inhibitor content:

Concerning the biochemical characters of faba bean genotypes, it was found highly significant differences between quality of total protein %, soluble protein %, available protein %and trypsin inhibitor content.

- **GIZA402:**

It was found that high total protein % soluble protein % and available protein % at 0.1% concentration of EMS as compared to control. In addition to, I was observed different content of trypsin inhibitor between higher or low levels at 0.1% concentration of EMS as compared to control in M_2 and M_3 generation.

- **GIZA2:**

It was found that high total protein %, soluble protein % and available protein % at 0.2% concentration of EMS as compared to control. In addition to, I was observed different content of trypsin inhibitor between higher or low levels at 0.1% and 0.2% concentration of EMS as compared to control in M_2 and M_3 generation.

- **GIZA3:**

It was found that high total protein % , soluble protein % and available protein % at 0.1 and 0.4% concentration of EMS as compared to control. In addition to, I was observed different content of trypsin inhibitor between higher or low at 0.1 and 0.2% concentration of EMS as compared to control in M_2 and M_3 generation.

- **FAB 337/78:**

It was found that high total protein % , soluble protein % and available protein % at 0.2 and 0.4% concentration of EMS as compared to control. In addition to, I was observed nearly to other in all concentration of trypsin inhibitor content but the lower measure at 0.1% concentration of EMS as compared to control in M_2 and M_3 generation.

- **FAB 89/74:**

It was found that high total protein %, soluble protein % and available protein % at 0.1% concentration of EMS as compared to control. In addition to, I was observed nearly to other in all concentration of trypsin inhibitor content but the lower measure at 0.1% and 0.2% concentration of EMS as compared to control in M_2 and M_3 generation.

- **FAB 114/80:**

It was found that high total protein %, soluble protein % and available protein % at 0.1, 0.3 and 0.4% concentration of EMS as compared to control. In addition to, I was observed very nearly to other in all concentration of trypsin inhibitor content but the lower measure at 0.1% concentration of EMS as compared to control in M_2 and M_3 generation.

It was selected any mutant lines of faba bean low in total protein % but was higher in the soluble protein % and available protein % .for example, Giza-402 at 0.2 % concentration, Giza-2 at 0.2% concentration, Giza-3 at 0.1%, FAB 337/78 and FAB 89/74 at 0.4% concentration and FAB 114/80 at 0.2% concentration of EMS as compared to control and found strong relationship between total, soluble and available protein % and improvement trypsin Inhibitor content with improve grain yield characters.

II.2 Protein Markers For Identification of Faba Bean *(Vicia faba L.)* Quality Characters: -

Now, SDS -PAGE can be used to classify and screening banding patterns from total soluble proteins according to different types of polypeptide by using ***Rm.*** *(Relative Mobility)* and the percentage of similarity indices. The Six *Vicia faba L.* varieties examined in the present study included representatives of the three main taxonomic groups of this species; i.e. Sp. Mediterranean (Giza-402, Giza-2 and Giza-3), Minor (FAB 337/78 and FAB 114/80) and Major (FAB 89/74).

The quantity of total protein content %, soluble protein content %, available protein content % and actively of trypsin inhibitor for these taxonomic types and mutant selected lines are Studied on green and dry seeds was performed in M_3 generation.

I had selected the best mutant lines from six varieties of ***Vicia faba L*** ; the high protein content ,the identification banding patterns proteins and low percent of similarity in the dry seeds were observed in the lines (T1/119, T2/2114, T4/414, T2/2412, T4/4410, T3/347, T3/341, T4/4310, T1/124, T1/1214, T2/223, T2/227, T4/421, T4/423, T4/4312, T4/4315, T3/3316, T3/336 and T3/3710).

III. DNA Molecular Markers For Identification of Faba Bean *(Vicia faba L.)* Protein Quality :

Two-enzymes *Eco RI* and *Hind III* were used for the double digestion of template DNA. The *Eco RI* and *Hind III* adapters were ligated to the ends of restriction fragments. The pre selective primers have a single base overhang which selects for fragments having extra base downstream of the restriction site.

Using four probe primers (OP1, OP2, OP3 and OP4) was initially screened with three entries to identify the most promising primers for detecting polymorphism.

In general, it can be concluded that sufficient polymorphism exists to allow distinction between the faba bean genotypes tested. The indices of genetic similarity among 19 mutant lines of faba bean genotypes. This analysis clearly distinguished the 19 mutant lines genotypes from all other varieties; it showed the different similarity values with all other mutant lines tested. This result is quite expected, considering the diverse origin and characteristics of these mutant lines compared to other. Among the other genotypes, showed high level of genetic similarity with values ranging from 50 to 86%, also showed low level of genetic similarity values less than 50%. Indicated those mutant lines selective from Giza-2, FAB 337/78 and FAB 89/74 reflect lower genetic similarity and diversity than Giza-402, Giza-3 and FAB 114/80 in Specific PCR analysis.