## SUMMARY

Flax (Linum usitatissimum, L.) is an important oil and fiber crop in A.R.E. and some other countries . It is liable to be infected by the fungus Melampsora lini (flax rust) . This disease lessens both quality and quantity of oil and fibers .

This investigation was carried out under field and greenhouse conditions to study the reaction to flax rust , as well as effect of infection on some other characters in four parents and five crosses including them .

1- Screening for resistance of parents, $F_1$ and $F_2$ generations were performed . Under field and greenhouse conditions, percentage of infected plants indicated that the parent Bombay was resistant while Giza 4 , Lin-seed N.P. SRR 1176 and Lin-seed N.P. Hybrid 68(1183) parents were susceptible .

2- Percentage of infected leaves and disease index showed also that Bombay parent was resistant . These two criteria were higher in the parent Lin-seed N.P.Hybrid 68(1183) than in Giza 4 and Lin-seed N.P. SRR 1176 parents .

3- Under field and greenhouse conditions ; five crosses and their reciprocals were studied in the $F_1$ and $F_2$

populations . The percentage of infected plants , leaves as well as disease index were found to be higher in crosses including the resistant parent Bombay .

4- Inheritance of flax rust was studied in five crosses performed between these four parents in both directions. The test was performed under field and greenhouse conditions .

a- The $F_1$ plants showed dominance of resistance in the two crosses Bombay X Giza 4 , Bombay X Lin-seed N.P. SRR 1176 and their reciprocals . The $F_2$ plants had segregated according to the ratio 3 : 1 indicating one pair difference .

b- The $F_1$ plants of the cross Giza 4 X Lin-seed N.P. SRR 1176 and its reciprocal were resistant while its $F_2$ plants segregated according to the ratio 9 : 7 indicating effect of two complementary genes .

c- The $F_1$ and $F_2$ populations of the two crosses Giza 4 X Lin-seed N.P.Hybrid 68(1183) and Lin-seed N.P. SRR 1176 X Lin-seed N.P.Hybrid 68(1183) showed to be susceptible .

5- Nature of resistance to this disease was detected by measuring the content of phenolic compounds in infected plants . Total, free and conjugated phenols were determined in the four flax parents and their $F_1$ hybrids

Amounts of these phenolic compounds were higher in the resistant parent Bombay than in the three susceptible Giza 4, Lin-seed N.P. SRR 1176 and Lin-seed N.P.Hybrid 68(1183) . Besides phenolic compounds were higher in the $F_1$ plants including the resistant parent Bombay . This may indicate that resistant plants have the ability to produce more phenolic compounds which may interfer with the mechanism of resistance . Such ability seems to be genetically controlled .

6- Effect of some seeddressers on infection was tested under greenhouse conditions . Seeds of the parent Giza 4 were dressed by the four fungicides Benlate T., Topsin 50, Bavistin and Plondrel and seedling were used for dectecting infection .

a- The percentage of infected leaves and disease index has decreased with increasing concentration of each fungicides as compared to control .

b- The fresh, dry weight and percentage of dry matter had increased with increasing concentration of each fungicide as compared to the control . But, the increase of these three criteria was insignificant .

7- Inheritance of some economic characters was determined in infected plants under field conditions . The inheritance of plant height was studied in the following three crosses performed in both directions ; Bombay (long) X

Lin-seed N.P. SRR 1176 (short) ; Giza 4 (long) X Lin-seed N:P. SRR 1176 (short) and Giza 4 X Lin-seed N.P. Hybrid 68(1183) (short) .

a- Tallness was found to be dominant over shortness and $F_2$ populations were continuously distributed indicating that plant height can be considered as a quantitative character . The estimated number of genes by Castle-Wright and Wright's formulae ranged from three to seven pair of genes . It was postulated that one or two pair of genes may affect this character by the Mendelian analysis .

b- In most of the crosses studied, genes may act either additively or multiplicatively except in the cross Lin-seed N.P. SRR 1176 X Giza 4 in which additive action was more than multiplicative .

c- The heritability values ranged from 85.97 % to 89.38 % , indicating that selection for this character may be effective .

8- Under field conditions, date to flowering was studied in three crosses and their reciprocals including the two early flowering parents Giza 4 and Lin-seed N.P. Hybrid 68(1183) and the two late flowering parents Bombay and Lin-seed N.P. SRR 1176 .

a- Late flowering seemed to be partially dominant over early flowering , and the $F_2$ population was continuously distributed indicating that date to flowering can be considered as a quantitative character . Castle-Wright and Wright's formulae indicated one or two pair of genes , while one pair of genes was found to affect this character by Mendelian analysis .

b- The nature of gene action seemed to be either additive or multiplicative .

c- Heritability values ranged from 82.45 to 87.18 % , showing that individual plant selection would be effective .

9- Tests of genetic association between some characters were carried out under field conditions . No association was found between reaction to flax rust and both plant height and date to flowering .

10- Under field conditions . Also , correlation coefficient (r) was estimated between number of infected leaves and each of six characters ; plant height , technical stem height , number of apical branches , date to flowering , number of capsules and number of seeds per capsule . The correlation coefficint gave insignificant positive and low values in most cases studied indicating weak correlation between these characters .