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5. SUMMARY

The aims of the present work were :

1- To study the inheritance of resistance to chocolate spot disease under artificial inoculation.

2- To determine the levels of phenolic compounds in the studied parents and their crosses.

3- To study the inheritance of earliness and some growth attributes.

4- To study the inheritance of yield and yield components.

Three varieties of faba bean (*Vicia faba*) were used in this study i.e Nubaria 1 (Giza Blanka) [resistant for chocolate spot], Giza 716 (moderately resistant) and Giza 40 (susceptible). Crosses were made between the three varieties as follows :

- Nubaria 1 ♂ X Giza 716 ♀ (Resistant X Moderately resistant).
- Nubaria 1 X Giza 40 (Resistant X Susceptible).
- Giza 716 X Giza 40 (Moderately resistant X Susceptible).

For each cross the six populations namely P_1, P_2, F_1, F_2, BC_1 and BC_2 were produced, raised and studied.

All the previous genotypes were grown in the field to study the previously mentioned characters. The number of spots and area were recorded as indicators of resistance to chocolate spot. Total, free and conjugated phenols were determined at the time of startiny infection and after 10 days from infection. The number of days to flowering, and the number of days to maturity were used to measure earliness. Plant height and the number of branches per plant were measured as indicators for growth characters. The following characters were recorded for yield

estimation i.e, the number of pods per plant, the number of seeds per plant, the seed yield per plant and 100-seeds weight.

The genetic parameters estimated were heterosis, type of gene action, broad and narrow sense heritability, expected genetic advance upon selection and genetic coefficient of variance.

Results obtained in this study could be summarized as follows :

5.1. Chocolate spot resistance :

1- F_1 plants were intermediate between their parental lines, F_2's and backcrosses also were intermediate between their parents. Crosses involving the resistant parent Nubaria 1 exhibited the highest levels of resistance and the crosses involving the moderately resistant Giza 716 or the susceptible Giza 40 genotypes exhibited lower levels of resistance.

2- Highly significant negative heterosis was observed in the first cross and significant negative heterosis was obtained in the second cross.

3- Additive gene effects predominated the expression of resistance to chocolate spot. Dominance effects, dominance X dominance were significant in two crosses. While, additive X dominance effects were highly significant in one cross.

4- High heritability values in broad sense were detected in the three crosses for chocolate spot resistance. High heritability in narrow sense were obtained in one cross and was nearly equal to its corresponding broad sense value, however, moderate heritability values in narrow sense were found in two crosses.

5- The expected genetic advance were moderate in the first and second crosses. However, low estimate of genetic gain was obtained in the third cross.

6- Low G.C.V% were detected in all of the crosses.

5.2. Plant phenolic compounds :

1- Total, free and conjugated phenols in the uninfected plants were found to be higher in the resistant plants than in the susceptible ones.

2- Infection with *Botrytis fabae* lead to an increase in free and total phenols in the resistant plants, however, in the susceptible variety Giza 40, free and total phenols decreased as a result of infection. Whil conjugated phenols increased in all varieties as a result of infection except F_2 in i.e cross (G. 716 X G. 40) and its BC_2.

3- Generations produced from crossing resistant and moderately resistant parents, their F_1's, F_2's and backcrosses (especially to resistant parent) had high content of phenolic compounds, while generations produced from crossing moderately resistant and susceptible parents, F_1's, F_2's and backcrosses (especially to susceptible parent) exhibited low content of phenolic compounds.

4- In the F_1 hybrids, F_2 and backcrosses, the degree of resistance and phenolic contents were found to be intermediate between their respective parental values.

5- Heterosis for total phenols estimated at the time of starting infection was negative and significant in the cross (N. 1 X G. 40). While after 10 days from infection highly significant and positive heterosis was observed in the cross (N. 1 X G. 716).

5.3. Earliness and growth characters :

1- Concerning the number of days to flowering and maturity, F_1's were intermediate between their parental lines. F_2's were also intermediate between the parents, but were slightly earlier than F_1. Backcrosses were closer to backcrosses parent, except BC_1 in crosses (N. 1 X G. 716) and (N. 1 X G. 40) for flowering date. Maturity date in F_1 and F_2 generations of the cross (G. 716 X G. 40) were closer to the earlier parent. The F_1 plant height was intermediate between the two parents in crosses (N. 1 X G. 716), (N. 1 X G. 40) and was higher than its higher parent in cross (G. 716 X G. 40), the F_2 plant height was intermediate between the parents in the three crosses, backcrosses were higher than their parents except BC_2 in cross (N. 1 X G. 40). Concerning the number of branches, F_1's and F_2's were intermediate between their parents, except F_1's in cross (G. 716 X G. 40) which was lower than the lowest parent. Backcrosses were intermediate between the two parents in crosses (N. 1 X G. 716), (N. 1 X G. 40) while in the cross (G. 716 X G. 40), BC_1 was slightly lower than the lower parent.

2- Heterosis for flowering date was observed to be positive highly significant in cross (N. 1 X G. 716). Regarding the number of days to maturity a significant negative value of heterosis was found in cross (G. 716 X G. 40). Positive highly significant heterosis were observed for plant height in all the crosses. For number of branches, highly significant negative heterosis was obtained in cross (N. 1 X G. 40).

3- The data indicated that additive gene effects play an important role in the inheritance of earliness and growth characters. Dominance gene effects were highly significant in some crosses for flowering date and

in all crosses for plant height but was significant in one cross for the number of branches. Epistasis were significant or highly significant in most of the cases for flowering date and maturity date. Additive X additive and dominance X dominance has an important role in the inheritance of plant height. However, additive X additive type of gene action was the most important gene action for the number of branches/plant.

4- High heritability values in broad sense were found for earliness and growth characters. High values of narrow sense heritability were recorded for flowering date in cross (G. 716 X G. 40), for maturity date in all the crosses and for the number of branches/plant in the crosses (N. 1 X G. 716) and (N. 1 X G. 40), these values were nearly equal to their corresponding broad sense. While, moderate values of narrow sense heritability were found for flowering date in the crosses (N. 1 X G. 40) and (G. 716 X G. 40), for plant height in the three crosses and for the number of branches in the third cross (G. 716 X G. 40).

5- The predicted genetic advance were low for the traits of earliness, plant height and for the number of branches in the cross (G. 716 X G. 40). While moderate genetic advance was obtained for the number of branches/plant in the crosses (N. 1 X G. 716) and (N. 1 X G. 40).

6- Low values of G.C.V% were obtained for earliness and growth characters in all of the studied crosses.

5.4. Yield and its components :

1- All the F_1 hybrids produced a number of pods per plant, number of seeds per plant and seed yield per plant higher than their high parents. While, for 100-seeds weight the F_1's values were intermediate between their parents. F_2's and backcrosses also were higher than their high parents for the number of pods per plant and number of seeds/plant in all crosses and for seed yield/plant in two crosses. While the F_2 and BC_2 of cross (G. 716 X G. 40) were intermediate between the parental values in seed yield/plant. Moreove, F_2 and backcrosses were intermediate between parental lines in 100-seeds weight.

2- The percentage of heterosis were positive and highly significant in all crosses for the number of pods/plant, number of seed/plant and seed yield/plant. Concerning 100-seeds weight, the percentage of heterosis was positive and highly significant in cross (N. 1 X G. 716) and positive and significant in cross (N. 1 X G. 40).

3- Additive gene effects play a significant role in the inheritance of yield and its components. Dominance effects showed the largest effects in controlling these traits beside the additive X additive and dominance X dominance. For 100-seeds weight, also additive X dominance were significant in all crosses.

4- High heritability values in broad sense were obtained for yield and its components in all crosses. For 100-seeds weight in crosses (N. 1 X G 40) and (G. 716 X G. 40), the values of narrow sense heritability were high and nearly equal to their corresponding broad sense. However, moderate to low narrow sense heritability were obtained for the remaining cases.

5- The expected genetic gain were moderate for the number of pods/plant in all of the three crosses, while low genetic gain were found for the number of seeds/plant, seed yield and 100-seeds weight in all of the three crosses.

6- Moderate genetic coefficient of variance (G.C.V%) was found for the number of pods/plant in the crosses (N. 1 X G. 716) and (N. 1 X G. 40), while low values of G.C.V% were obtained in for the remaining cases.