SUMMARY

Fusarium oxysporum f.sp. *cumini* is universally considered among the most virolent fungi that infects cumin plants causing damping-off and wilt. Whereas, *F. solani* is considered also one of the destructive fungi that infect roots of cumin plants causing root-rot or stem rot. *Fusarium* species are generally considered as seed or soil-borne pathogens.

The present investigation was planned to isolate and identify the seed and soil-borne fungi that attack cumin in ARE and to study the effect of some physiological factors on the above-mentioned two fungi isolated from cumin diseased plants or cumin seeds and seedlings and their control.

The obtained results could be summarized as follows :

1. Inoculation and pathogenicity tests indicated that :
   a) *F. oxysporum* f.sp. *cumini* and *F. solani* are responsible for causing damping-off, wilt, and root-rot diseases to cumin plants in A.R.E.
   b) *Aspergillus niger*, *A. flavus*, *Penicillium* sp., *Cladosporium* sp. and *F. semitectum* are saprophytic fungi responsible for causing rotting of cumin seeds.
   c) *Alternaria alternata* is responsible for causing seed rot in soil and infects also the aerial parts of cumin plants.

d) Verticillium sp. and Cephalosporium sp. could be considered as saprophytes.

e) Stemphyllium sp., Curvularia lunata, and Drechslera tetramera could be considered as pathogenic fungi of aerial parts. Also, data of seedling symptoms test, percentage frequency of isolated fungi, and data of seed-borne fungi confirm the above mentioned results.

2. F. oxysporum f.sp. cumini and F. solani were isolated more frequently from diseased cumin plants collected from different localities in A.R.E. than the other fungi, except Alternaria alternata and which was F. solani isolated from seed samples more frequently than the other fungi.
3. F. oxysporum f.sp. cumini was found to be the most destructive pathogen on cumin plants in pre- and post-emergence damping-off and was followed by F. solani.
4. A detailed study of the characteristics of growth, of each fungus associated with cumin seeds was prepared.
5. Inspection of dry seed indicated that there is a positive correlation between the percentage of emergence and quality indexes of seeds, which decreased by increasing the impurities and vice versa.
6. The blotter method proved to be better in isolation of most seed-borne fungi than the agar plate one, especially

in case of isolation of A.alternata, Penicillium spp., Cladosporium sp. and Aspergillus spp., which appeared in higher counts on agar and their growths and spores complicated the isolation of other fungi. However, percentages of Fusarium spp. increased by soaking seeds in Czapek's liquid medium for 10 min., which could be attributed to their under fruit coat and endospermic growths.

7. Three seed samples collected from different localities (Dayrout, Manfalout, and Mallawi) differeng in their values of seed-borne fungi resulted in the following :

   a) Decrease in germination % were in conformance with increase of seed-borne infection .

   b) Different pathogenic fungi (Alternaria alternata and F. solani) were associated with abnormal seedlings of cumin (category 1 and 2).

   c) No evidence of growth regulator substances in category 1 of abnormality ; abnormality was not affected by cultural fungal filterate and the last reduced seed germination.

   d) All isolated fungi could be arranged descendingly according to their total percentages of frequency from both seeds and seedlings as follows : A. alternata, F. solani, F. oxysporum f.sp. cumini, D. tetramera, Stemphyllium sp., F. semitectum, C. lunata, Verticillium sp. and Cephalosporium sp.

8. Isolation from seed parts indicated that :
   a) The testa and seed coat of cumin seeds contained most of fungi associated with the whole cumin seed.
   b) F. oxysporum f.sp. cumini was isolated from seed coat and endospermic tissues only.
9. As for hot-air treatment of seeds, spores viability of all tested fungi was decreased by 50°C and 60°C for 5, 10, 15 and 20 min. In 1983, average numbers of conidia, obtained from the washing test, of fungi -in a decreasing order - were A. niger, A. alternata, D. tetramera, F. semitectum, F. solani and Stemphyllium sp.
   In 1984, similar results were obtained with seven species of fungi, but spore load of most fungi in 1983 seed sample was more than that of 1984 sample. However, seed-borne ', abnormal seedlings , seed germination , and infected seedlings decreased by heating treatments.

10.a. The percentages of pre- and post-emergence and wilt increased by increasing the depth ofssowing in soil infested with F.oxysporum f.sp. cumini or F.solani or sterilized uninfested soil with seed-borne diseases.

   b. The percentages of disease incidence of Fusarium spp. as soil-borne or seed-borne diseases, increased by shortening the watering intervals. Similar results were obtained as regards seeding rates effect on disease incidence.

11. As for the effect of treating seeds with two growth regulators (GA_3 and NAA) and their effect on linear growth of pathogenic fungi :

a) In vitro, on Czapek's medium, the linear growth of F. oxysporum f.sp. cumini and F. solani decreased and more affected by NAA than GA_3. GA_3 at 40 or 80 ppm gave the lowest linear growth, while it decreased at 100 ppm of NAA. On contrast with F. solani, as the lowest linear growth was obtained at 100 ppm of GA_3 and 40 ppm of NAA.

b) In vivo, all concentrations of GA_3 and NAA increased seed emergence and post-emergence phase in both seasons in soil infested with F. oxysporum f.sp. cumini and the lowest percentages of healthy survival plants were at 40 or 80 ppm of NAA in 1983, while it was at 80 ppm of NAA in 1984. Similar results were obtained in case of soil infested with F. solani. However, the lowest percentage of healthy survival plants was at 80 ppm of NAA.

Under field conditions emergence and post emergence damping-off were not affected by soaking seeds in the two growth regulators whereas the percentage of wilted plants increased by all concentrations of the two growth regulators. Also, the dry weight of plant and yield components decreased by treating the cumin seeds with GA_3 and NAA in both

seasons. However, on the other hand GA_3 at 5, 10 and 20 ppm increased oil yield/plant in 1984 only, on contrast with treating with NAA.

12.1) The effect of fertilization in greenhouse or in artificially infested soil or with natural infection of seeds, was as follows :

a. Addition of N-fertilizer alone decreased disease incidence.

b. Addition of (P) fertilizer alone decreased slightly disease incidence.

c. Addition of (K) fertilizer alone decreased disease incidence. However, addition of (K) fertilizer decreased disease incidence more clearly than addition of (P) fertilizer alone.

d. The best combined treatments for obtaining the best results of disease reduction were N_1P_1K (1.00 g . : 1.01 g . : 2.58 g ./plot) and N_1P_2K (1.00 g . : 1.52 g . : 2.58 g ./plot).

2) The effect of fertilization in the field :

a. Addition of N fertilizers alone at the rate of (N_1) 200 kg./fed. decreased the percentages of pre- and post-emergence damping-off and wilted plants in both seasons. These percentages increased by the increase in N fertilizers especially N (400 kg./fed.).

b. Addition of either (P) or (K) fertilizer alone at different rates decreased the percentages of pre- and post-emergence damping-off and wilted plants.

c. The best combined treatments for obtaining the best results of disease reduction and increase in yield components were that of N_1P_1K (200.0 kg. : 200.0 kg. : 500 kg./fed.) or N_1P_2K (200 kg. : 300.0 kg. : 500 kg./fed.

13. As for studying the effect of ten systemic and contact fungicides on disease control and yield components, the following results were obtained :

a. In vitro, the most effective fungicides were Vitavax 75 followed by Vitavax/Captan in reducing the linear growth of F. oxysporum f.sp. cumini. The linear growth was inhibited by 100 ppm of Benlate 50, Captan 75, Dithane M-45, Botec whereas 40 ppm of Vitavax 75; 80 ppm of Vitavax/Captan and Homai 80 gave almost similar results.

As for F. solani, Vitavax/Thiram was the most effective fungicide followed by Vitavax/Captan as they inhibited the linear growth at 20 ppm and 60 ppm, respectively. In this respect, Vitavax 75 inhibited the linear growth at 80 ppm.

b. Results as regards, seed treatment on seed-borne fungi , seed germination , abnormal seedlings ,

and infected seedlings were Vitavax 75, and Homai 80 followed by Vitavax/Captan. However, Dithane M 45 was the most effective in season 1983, whereas Dithane M-45 and Vitavax/Captan were the most effective, followed by Vitavax 75 and Homai 80 in season 1984, in reducing percentages of seed-borne fungi, abnormal seedling, and infected seedlings. However, seed germination was increased by the former fungicides.

c. In vivo :

* Under greenhouse conditions, Homai 80 (0.60 %) or Vitavax/Captan (0.50 %) or Vitavax/Thiram (0.50 %) should be recommended for controlling disease incidence of Fusarium spp. as soil-borne or seed-borne diseases that attack the roots of cumin plant.
* Under field conditions, it could be recommended to use Homai 80 (0.60 %) or Vitavax/Thiram (0.50 %) or Vitavax 75 (0.50 %) as seed dressing for obtaining better results as regards seed yield/plot, oil yield/plant, and weight of 1000 seeds together with disease control. Although Vitavax/Captan, Vitavax/Thiram, Botec, Benlate 50, Thiram and Captan 75 gave good results in reducing the disease incidence in the field. Moreover, fertilization with N_1P_1K (200.0 kg. : 200 kg.: 500 kg./fed.) or N_1P_2k (200.0 kg. : 300.0 kg. : 500 kg./fed.) resulted in the highest value of field components together with disease control.