SUMMARY

There are many different methods used in inhibiting and controlling fungal growth in food and in agricultural commodities. Traditional methods using chemical compounds, heat and biological control have limited effect and many disadvantages as well. A modern, advanced and clean technology is now well established and known as "Food irradiation technology". This technology approved to be effective and efficient in controlling fungi contaminating agricultural commodities. However, it was found that some fungal genera such as *Curvularia.*, *Alternaria* and *Fusarium* are more resistance to ionizing radiation than others.

The aim of the present study was:

1- Isolation and identification of radiation-resistant fungi (*Curvularia* spp., *Alternaria* spp. and *Fusarium* spp.) from their natural products particularly foods, feeds, soil, ...etc.

2- Determine the "radiation decimal reduction dose" (D_{10}-value) of fungal spores to know the sensitivity or resistance of these molds to irradiation.

3- Examine the role of cellular composition (total proteins, amino acids, total lipids, fatty acids, DNA and RNA content) in the radiation-resistance.

4- Prevention of mold growth contaminating the food by using irradiation.

In this study, fifty three isolates of, *Curvularia* (C), *Alternaria* (A) and *Fusarium* (F) were isolated from different sources i.e. wheat (w), potato (p), tomato (t), mandarin (m), fenugreek (f), bread (b), orange (o), lupine (*l*), chicken feed (c), soil (s) and air (a). Five isolates were selected

from each genus according to the difference in the morphological characters and the source of food. The obtained results were summarized as follows:

1- The growth diameter of Cl_1 exposed to 10.0 kGy recorded 7.0 cm after 6 days of incubation while it reached 4.0 cm after 7 days of incubation in case of Co. Meanwhile, dose level 6.0, 8.0 and 9.0 kGy completely inhibited the growth of Cl_2, Ca and Cs, respectively.

2- The growth diameter of Am and Af, completely inhibited after exposuring to 9.0 kGy, while Ac recorded 2.9 cm after 7 days of incubation at the same dose. Meanwhile 5.0 kGy completely inhibited the growth of Ab and At.

3- The growth diameter of Fp, Ft, Fs and Fc completely inhibited after exposuring to 4.0, 7.0, 8.0 and 9.0 kGy, respectively after 7 days, while Fw completely inhibited at 6.0 kGy after 5 days.

4- Two isolates from each genus were chosen to represent the highest and lowest radiation resistance of the three genera for further studies. The relative resistant isolates identified as *Curvularia lunata* (Cl_1), *Alternaria alternate* (Ac) and *Fusarium oxysporum* (Fc), while the sensitive isolates identified as *C. tuberculata* (Cl_2), *A. tenuissima* (At) and *Fusarium semitectum* (Fp).

5- The radiation resistance of the six fungal species was studied as a function of biomass. The biomass of the six resistant and sensitive fungal species were decreased by increasing the dose level of radiation; dose level 8.0 kGy almost inhibited the growth of *C. tuberculata* and *F. semitectum* while it decreased the dry mass of *C. lunata, A. alternata, A. tenuissima* and *F. oxysporum* by 67.8, 47.8, 92.0 and 61.2%, respectively.

6- The radiation resistance of the six fungal species belonging to *Curvularia, Alternaria* and *Fusarium* was studied through determination of D_{10}-value. D_{10}-value (the radiation dose in kGy which kills 90 % of the initial count of the cells) of the six selected fungal species were studied. Treatment of fungal spores with radiation reduced their viable counts and this reduction was proportional with the irradiation dose. The D_{10}-values of *C. lunata, C. tuberculata, A. alternata, A. tenuissima, F. oxysporum* and *F. semitectum* in saline solution were found to be 1.92, 1.25, 1.47, 0.47, 1.31 and 0.70 kGy, respectively. Meanwhile, in lupine seeds, the D_{10}-values of *C. lunata* and *C. tuberculata* were 2.25 and 1.56 kGy respectively, and in chicken feed, the D_{10}-values of *A. alternata, A. tenuissima, F. oxysporum* and *F. semitectum* were 1.70, 1.30, 1.83 and 1.23 kGy respectively. It could be noticed that the D_{10}-values of these fungi under investigation were higher in substrates than saline solution.

7- The total protein content of the three relative resistant strains *C. lunata, A. alternata* and *F. oxysporum* were 76.88, 72.69 and 69.83%, respectively, while three relative sensitive species *C. tuberculata, A. tenuissima* and *F. semitectum* were less than the resistant once since they recorded 70.13, 64.06 and 46.88%, respectively.

8- The content of the total amino acids in *C. lunata, A. alternata* and *F. oxysporum* were 129.2, 114.4 and 49.2 mg/g, respectively, while in the relative sensitive strains: *C. tuberculata, A. tenuissima* and *F. semitectum* were 101.0, 74.0 and 63.2 mg/g, respectively. Meanwhile, the resistant strains: (*C. lunata, A. alternata* and *F. oxysporum*) contain higher content of sulfur containing amino acids (Cysteine, Methionine) or double bond amino acids

(histidine) than the relative sensitive strains: *C. tuberculata*, *A. tenuissima* and *F. semitectum.*

9- The total lipids content of the highly relatively resistant strains: *C. lunata, A. alternata*, *F. oxysporum* were 16.26, 12.57 and 8.16%, respectively. Meanwhile, the total lipids in the relative sensitive strains: *C. tuberculata, A. tenuissima* and *F. semitectum* were less than the resistant once, since they recorded 6.99, 3.91 and 5.76 % respectively.

10- The percentages of the total unsaturated fatty acids in the resistant strains: *C. lunata, A. alternata* and *F. oxysporum* were 73.48, 71.68 and 70.11 %, respectively, while in the relative sensitive strains: *C. tuberculata, A. tenuissima* and *F. semitectum* were less than the resistant once, since they recorded 69.11, 68.67 and 53.38 %, respectively.

11- The total nucleic acids content of the resistant strains *C. lunata, A. alternata* and , *F. oxysporum* were 36.63, 35.13 and 33.41 mg/g, respectively, compared with 29.60, 28.17 and 28.46 mg/g for *C. tuberculata*, *A. tenuissima* and *F. semitectum*, respectively.

12- Gamma irradiation with dose level 4.0 kGy decreased the total protein content, in the tested strains, especially in the sensitive ones since they recorded 9.45, 15.55 and 14.23 % for *C. tuberculata, A. tenuissima* and *F. semitectum,* respectively compared with 6.50, 8.52 and 9.42 % for *C. lunata, A. alternata* and , *F. oxysporum,* respectively in the relative resistant ones.

13- Gamma irradiation with dose level 4.0 kGy decreased the content of the total amino acids to 109.6, 62.0, 62.6, 59.6, 36.6 and 55.6 mg/g in *C. lunata*, *C. tuberculata, A. alternata*, *A. tenuissima*, *F. oxysporum* and *F. semitectum*, respectively, especially, sulfur containing amino acids (cysteine, methionine) or double bond amino acids (histidine).

14- Gamma irradiation with dose level 4.0 kGy decreased the total nucleic acids content, in the tested strains, especially in the sensitive ones since they recorded 30.7, 46.75 and 34.29 % for *C. tuberculata, A. tenuissima* and *F. semitectum,* respectively compared with 20.28, 21.72 and 27.18% for *C. lunata, A. alternata* and , *F. oxysporum,* respectively in the relative resistant ones.

15- The values of RNA and DNA decreased by exposure the tested species to 4.0 kGy, but the percentage of decreasing were higher in DNA than RNA, also higher in the relative sensitive strains than the resistant strains. The percentage of decreasing recorded 32.8, 33.7 and 29.7 % in the resistant strains: *C. lunata, A. alternata* and *F. oxysporum*, respectively, compared with 40.6, 59.4 and 55.0 % in the sensitive strains *C. tuberculata, A. tenuissima* and *F. semitectum.*

16- The results of the storage experiment showed that the count of *C. lunata, A. alternata* and *F. oxysporum* (the relative resistant ones) artificially contaminated lupine seeds or chicken feeds increased after the first month either in the unirradiated or irradiated samples with doses (2.5-7.5 kGy). Thereafter the remain cells decreased gradually during the end of the storage periods (3 months). 10 kGy was sufficient to complete elimination of *F. oxysporum* contaminated chicken feeds, while 12.5 kGy completely freedom chicken feeds or lupine seeds from *A. alternata* and *C. lunata*, respectively.