PHYSIOLOGICAL EFFECTS OF GAMMA-RADIATION ON SEED GERMINATION

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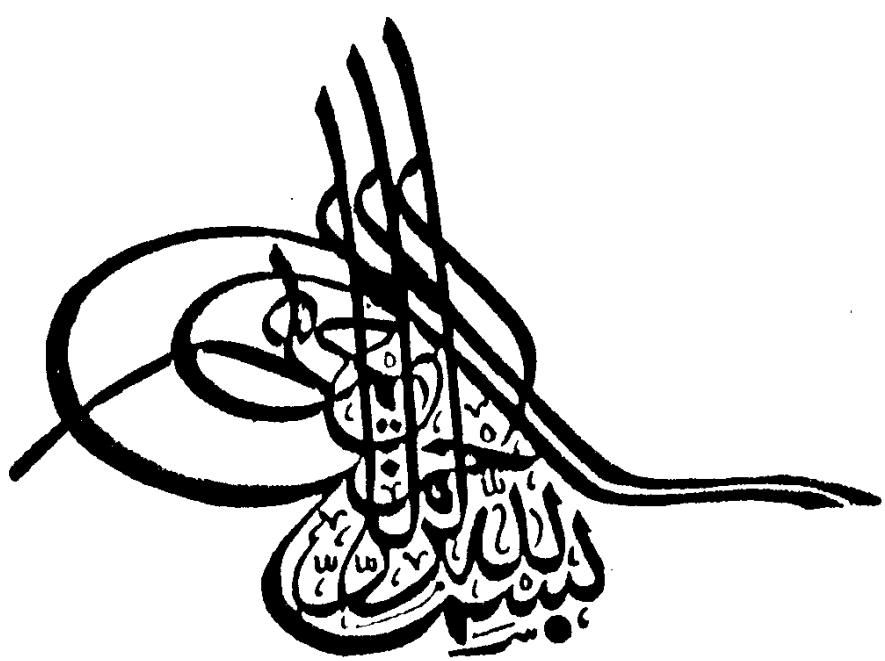

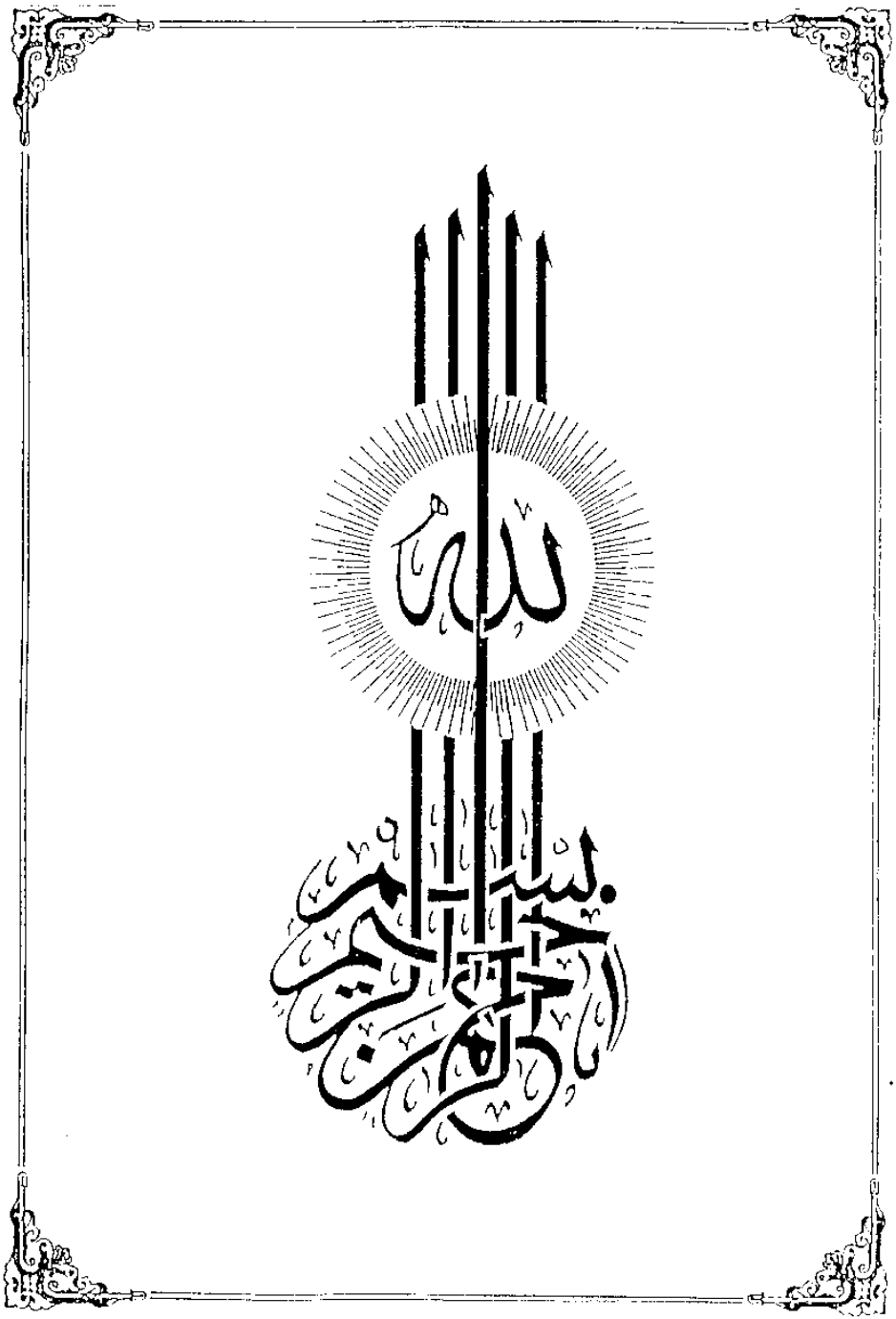

TO

MY PARENTS

and

MY HUSBAND

This thesis has not been previously submitted for any degree at this or at any other University.

Somia Salah-EL-Dien El-Akkad.

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INTRODUCTION AND AIM OF WORK

INTRODUCTION

The application of radiation in different biological fields is now of prime importance. In spite of the intensive work with the different types of radiation in different purposes, it is somewhat surprising to find that so much uncretainty yet exists concerning their exact behaviour inside the living organisms. However, some of the immediate physiological changes which occur in living matter when radiation energy is absorbed are now well understood, but the complex sequence of events concerning these changes with the ultimate alternations in the cellular behaviour to which they give rise, is still largely unknown.

Radiation had accepted the attention of most, if not all, the scientists including physiologists, ecologists cytologists, pathologists and those Who are concerned with the field of plant breeding. In this respect, one may mention the striking application of radiation in the purpose of improving the food quality and its storageability. Numerous review articles are available on the changes produced in irradiated foods (Roushdy et al ., 1973; Elsayed, 1973 and Mahmoud, 1973). Radiation technique had proved to be very useful in the technological processing and nutritive

value of foods. Publications of Vakil et al.(1973)established the wholesomeness of irradiated foods on short and long-term feeding tests with experimental animals. Low-irradiation dose had been reported not to alter the nutritive value of foods. However, Ananthaswamy et al. (1971) reported that some changes occurred in the physico-chemical properties of macro-compounds like starch and proteins of foods may be expected to improve food quality.

In the following, the most important and striking effects of gamma and other ionizing radiations on the physiological state of plants will be reviewed.

Gamma radiation effects on seed germination

The sharp reduction in the percentage of seed germination is the most obvious effects of gamma radiation at the higher dosage levels. Singh (1974) observed that germination percentage of safflower seeds was gradually reduced as the doses of radiation increased. Exposures of the order of 40, 45 and 50 KR resulted in complete mortality. Consistent results were obtained by Van Huystee (1967) with pea nut seeds exposed to 250 and 500 KR of X-rays which showed 30 and 50 % reduction in germination respectively and 759 KR had completely inhibited their

germination. Also., Rokba & Aly (1982) showed that exposing seeds of some citrus varities to acute doses of gamma rays had reduced the germination percentage by 7.9 % to 69.7 %. Moreover, irradiation treatments with the higher doses had delayed the seed germination from 4 to 7 days. El-Shafey (1978) found that higher doses of gamma rays (10000, 25000 and 50000 r.) markedly decreased the percentage of germination of the treated Vicia faba seeds.

However, the relatively adequate doses of gamma rays were reported to increase the percentage of germination and accelerate this process. In this respect, one may refer to the work of Woodstock & Justice (1967) and Banacher et al. (1971) who found that radiation doses (0.66 to 11 K rad) had a stimulating effect on germination of carrot seeds. Similarly, Shamsi et al. (1978) recorded that doses of 0.5 KR and 0.75 KR stimulated germination in three cultivars of broad bean. Badr and Abdel-Maksoud (1981) reported that low gamma radiation doses (1-5 KR) increased germination percentage of Portulaca grandiflora. Also, Lebedinete (1971) observed that under the effect of low doses of radiation (1000-3500 R) peanut seed germination was stimulated. Application of 3 and 5 K rad of gamma rays to Sorghum grains had increased the percentage of their germination (Sharon & Muralidharan, 1978).