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Effect of Gamma Irradiation on the Anatomical and Histological Structure of Some Egyptian Wheat (*Triticum aestivum* L.) Cultivars

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THE EFFECT of Gamma rays (150, 250, 350 and 450 Gy) on the flag leaves and stems anatomical structure in four wheat cultivars Sids-1, Sahel-1, Sakha-93 and Giza-168 were investigated. Flag leaf thickness was reduced with all doses of gamma-rays in both Sids-1 and Sahel-1 cultivars. However, an evident increase in thickness of flag leaves was detected with gamma-rays levels of 250 and 450 Gy in Sakha-93 and with 250,350 and 450 Gy in Giza 168 cultivars. The increase or decrease occurred in flag leaf thickness was corresponded with similar response in various tissues of flag leaf (Abaxial and Adaxial epidermal layers, mesophyll tissue and vascular tissue). Stem diameter/cross-section were decreased as a result of gamma irradiation in all studied wheat cultivars except few treatments. The reduction was associated with inhibition occurred in various area occupied by different tissues of stem transverse-section (Sclerenchymatous, ground tissue, vascular tissue and pith cavity). Sensitivity of stem tissues to gamma irradiation was completely differ from that observed on flag leaf tissues. Therefore, both stimulation or reduction occurred on stem diameter/cross section was corresponded with increase or decrease in number of ground tissue cell layers, whereas there were no change in number of mesophyll tissue layer of flag leaf. The present investigation revealed differences in radio-sensitivity between wheat cultivars as well as between plant tissue and organs. Flag leaves tissues were more sensitive to gamma irradiation than stem tissues.

Keywords : Gamma rays, Wheat cultivars, Anatomy.

Wheat is one of the most important cereal crops used in human and animal consumption, under environmental condition of Egypt. Wheat cultivars markedly vary in their growth parameters and potential yield (El-Kalla *et al.*, 1992 and Kassam & Nasr, 1995). Recently the use of irradiation, in particular gamma-rays was established in order to stimulate growth parameters and to induce genetic changes in different crop plants (Abdel-Hady and Ahmed, 2004 , Amin, 2003 and Azer, 2001). Yankulov (1979) found a relationship between radio-sensitivity and mutability of crop cultivars. Also, Ukai-Rasuo and Yamashita (1980), Xu-Meifen and Xu-Weijie (1986) and Yi-Huying *et al.* (1995) reported that, the crop cultivars could be divided into radio-sensitive and radio-resistant groups. They also showed that, the intervarietal differences of radio-sensitivity could be expressed as depression in growth parameters and chromosomal aberrations.

The purpose of this study was to investigate the sensitivity of some Egyptian wheat cultivars to gamma irradiation through anatomical and histological examination of both leaves and stems tissues. However, no work has been reported on the influence of gamma irradiation on the anatomical structure of Egyptian wheat cultivars.

Material and Methods

The present investigation was carried out under greenhouse condition of Botany Department, National Research Centre, Giza, Egypt.

A- Plant material

The grains of the four bread wheat (*Triticum aestivum* L.) cultivars, Sids-1, Sahel-1, Sakha-93 and Giza-168 were supplied from Agriculture Research Centre, Ministry of Agriculture, Giza, Egypt.

B-Methods

1- Irradiation

The moisture content of wheat grains were stabilized for two weeks in a desiccator over 60% glycerin before irradiation processes (Azer, 2001). The grains of the four wheat cultivars were subjected to gamma-rays doses of 0, 150, 250, 350 and 450 Gy. Irradiation was carried out at National Center for Radiation Research and Technology (NCRRT), Giza, Egypt.

2- Planting

The grains of wheat cultivars were sown during winter season of 2003 and 2004 at 15th and 20 of November, respectively.

The grains of irradiated and unirradiated wheat cultivars were sown in earthen pots 40 cm diameter containing about 12 kg of clay loam soil at the rate of seven grains per pot, then thinned to three seedling per pot. Calcium superphosphate (15.5 % P_2O_5) was added pre sowing at the rate of 5 g/pot. Ammonium nitrate (33.5 % N)at the rate of 5g/pot was applied twice at seedling and tillering stages of growth.

3- Anatomical procedures

Samples for anatomical investigation were taken from center portion of flag leaf and third internodes of the main stem at heading stage (85 days from sowing) samples were excised and fixed immediately for 72 hr, in a formaldehyde-basedfixative containing 95% ethanol, 5 ml glacial acetic acid, 10 ml 37% formaldehyde and 35 ml distilled water. Plant tissues were dehydrated in graded ethanol series, embedded in paraffin wax; sectioned by rotary microtrome (10-15 µm), stained with safranine and fast-green stain procedure (Clark, 1981) and mounted in Canada balsam. To determine thickness of flag leaves and stems

tissues, a standrized linear ocular micrometer was used. For anatomical examinations, five independent plants of each treatment/genotype were chosen, and five cross-sections per plant were obtained. Mean values of 10 readings per cross–section ± S.E. were analyzed according to Snedecor and Cochran (1980). The transverse-sections were examined and photographed by Nikon light microscope and Nikon camera, Fx-35.

Results and Discussion

Effect of gamma irradiation on flag leaves anatomical structure of some Egyptian wheat cultivars

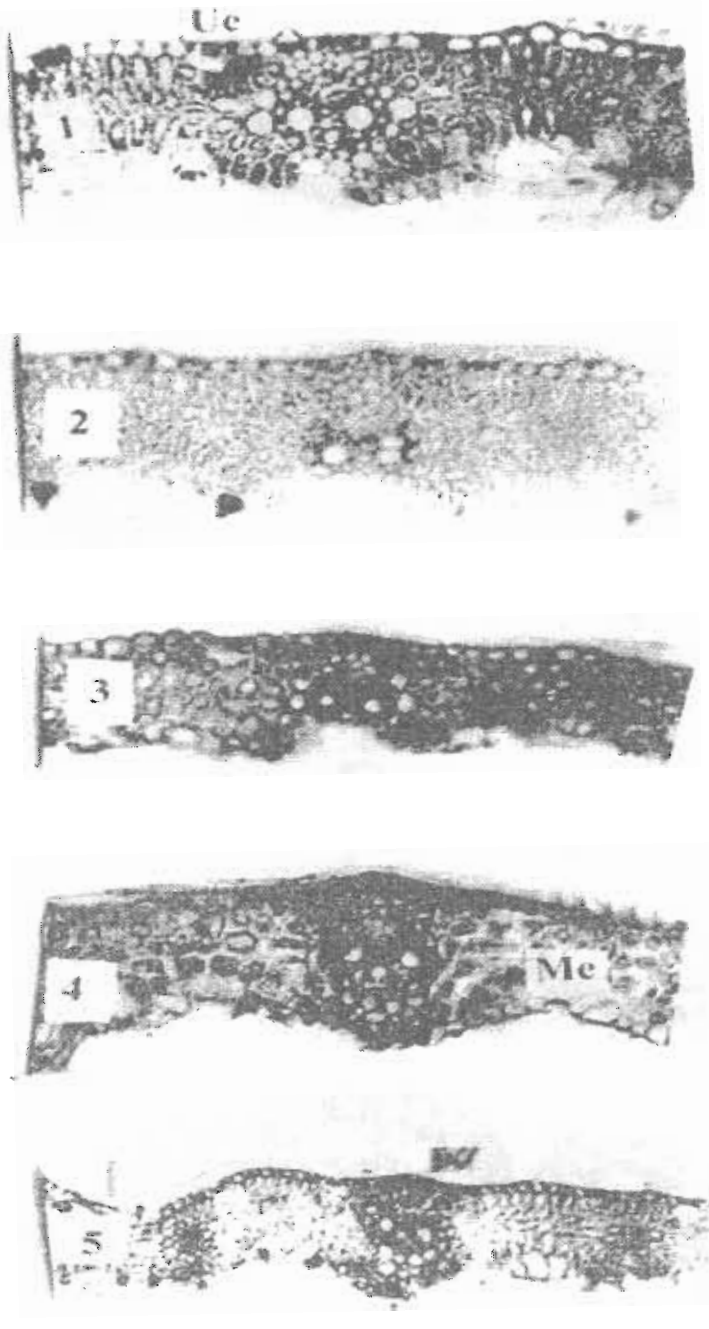
The Abaxial and Adaxial epidermal layers of flag leaves of the four wheat cultivars were composed of one layer of epidermal cells, which vary in shape and size (Plate A, 1, 6, 11 and 16). Furthermore , the lower epidermal cells were more bigger in size than that of the upper epidermal cells.

The response of epidermal cells to gamma irradiation was inconsistent as recorded in Table 1. Thickness of both upper and lower epidermal cells was slightly reduced by increasing gamma-rays dose from 250-450 Gy in Sids-1 cultivar. Whereas, no differences in thickness of both Adaxial and Abaxial epidermal layers was recorded between irradiated and unirradiated plants in Sahel-1 cultivar. Similar response was also observed at lower epidermal layer in Sakha-93 cultivar. However the maximum increase in thickness of upper epidermal layer were recorded with 150, 250 and 450 Gy gamma rays in Sakha-93 genotype and with 250, 350 and 450 Gy gamma rays in Giza-168 genotype whereas, the lower epidermal layer was only increased in thickness at gamma-rays dose of 450 Gy in Giza-168 genotype and at 150 Gy in sids-1 genotype (Table 1).

As comparing to the control, normal and regular shapes of upper epidermal cells were resulted from gamma rays treatments at 150 and 250 Gy in sids-1 cultivars (Plate A, 2 and 3). This response was also observed with gamma rays dose of 350 Gy in Sakha-93 and Giza-168 cultivars (Plate A,14 and 19). Shrinking shape of the upper epidermal cells was recorded with gamma-rays at 150 Gy in Sahel-1 cultivar (Plate A, 7). However, hypertrophy and irregular shape of upper and lower epidermal cells was distinguished at gamma-rays doses of 250 and 450 Gy in Giza-168 and Sakha-93 cultivars, respectively (Plate A 13, 15, 18 and 19). A complete disruption of epidermal layers was only recognized

TABLE 1. Effect of gamma irradiation on flag leaves anatomical structure of four Egyptian wheat cultivars .

Characters and thickness (µm)		Epidermal layers				Vascular bundles			
		Upper		Lower		Length		Width	
Wheat genotypes and Gamma rays doses (Gy)		Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE
Sids-1	control	18.00	0.58	27.00	1.53	235.00	2.89	160.00	2.89
	150	18.00	1.00	28.00	1.15	120.00	2.31	101.00	1.73
	250	16.00	1.73	24.00	1.15	158.67	1.33	136.00	2.31
	350	15.00	0.58	23.00	1.53	119.00	3.06	120.00	1.15
	450	16.00	0.58	23.00	1.73	123.00	1.73	158.00	2.08
Sahel-1	control	17.00	1.15	16.00	1.15	132.00	3.06	94.00	2.31
	150	16.00	1.15	17.00	1.15	101.33	1.76	93.33	2.03
	250	17.00	1.15	16.00	0.58	120.00	1.15	82.00	2.52
	350	16.00	0.58	17.00	0.58	107.00	1.73	80.00	2.31
	450	17.00	0.58	16.00	1.73	123.00	1.73	97.33	2.96
Sakha-93	control	16.00	1.15	25.00	1.15	120.00	1.15	121.00	1.53
	150	23.00	1.53	23.00	2.08	80.00	1.73	96.00	1.73
	250	23.00	1.73	23.00	1.73	119.00	3.06	120.00	1.73
	350	17.00	1.15	24.00	1.15	118.00	1.53	83.00	1.73
	450	24.00	1.15	26.00	1.15	158.33	0.88	144.00	2.31
Giza-168	control	16.00	0.58	24.00	1.73	163.00	1.73	120.00	1.73
	150	17.00	0.58	17.00	1.15	123.00	1.73	103.00	2.08
	250	23.00	1.53	24.00	1.73	123.00	1.73	154.00	0.58
	350	24.00	1.15	23.00	1.73	93.00	1.73	83.00	2.08
	450	26.00	1.15	30.00	1.53	123.00	2.08	154.00	2.08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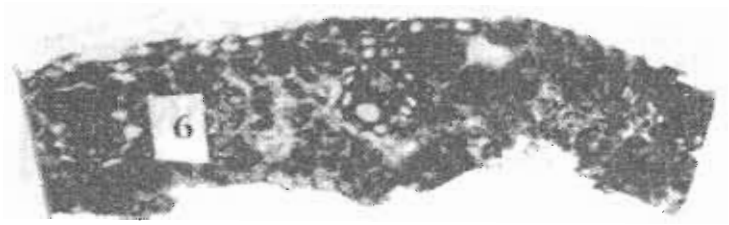
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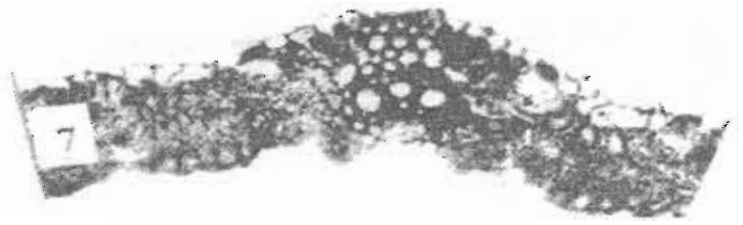
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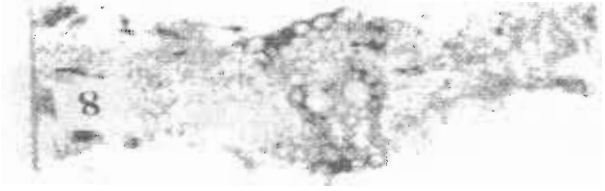
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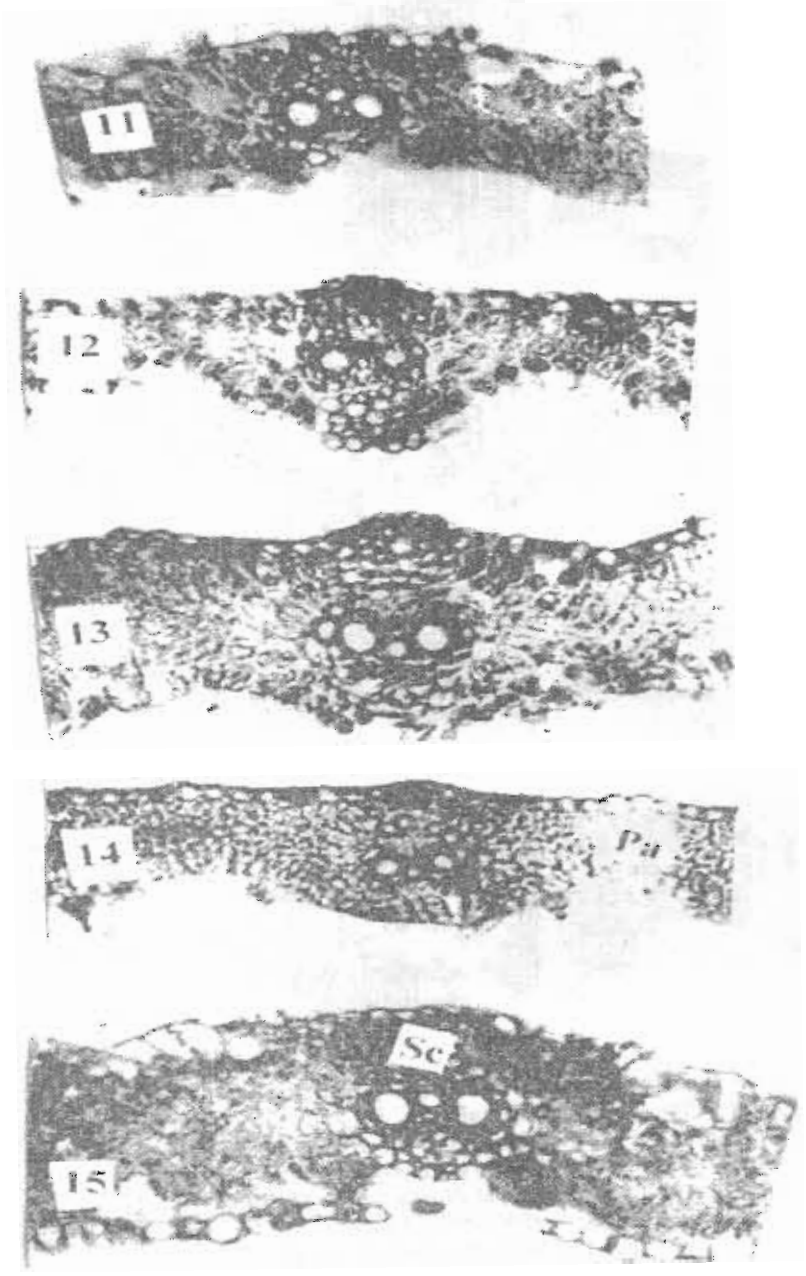
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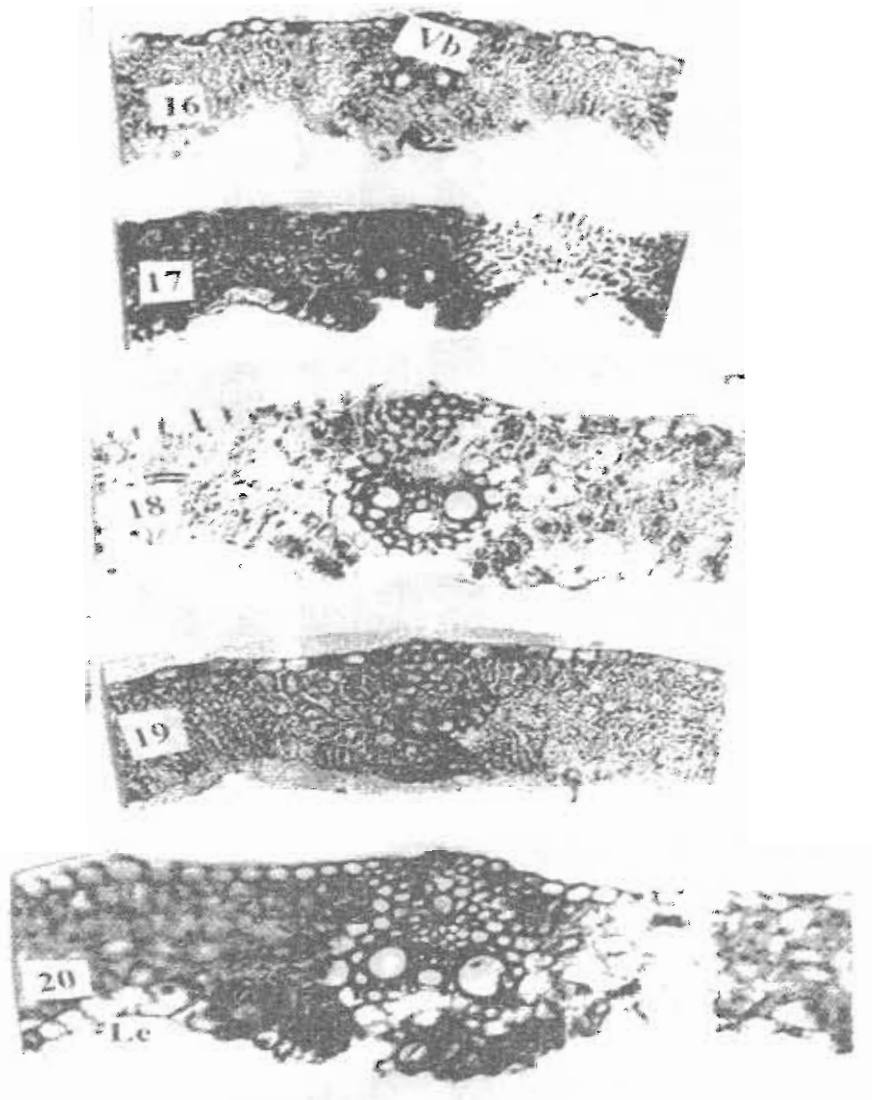


Plate A (1-20). The effect of gamma-rays treatments on the flag leaves anatomical structure of four wheat cultivars. 1-5, Sids-1 cv., 6-10 Sahel-1 cv. 11-15 Sakha-93 cv. and 16-20 Giza-168 cv., 1, 6, 11 and 16 control, 2, 7, 12 and 17 treatment with gamma-rays at 150 Gy. 3, 8, 13 and 18 treatment with 250 Gy of gamma rays. 4, 9, 14 and 19 treatment with 350 Gy of gamma rays. 5, 10, 15 and 20 treatment with 450 Gy of gamma rays. Up., upper epidermal layer, Le., lower epidermal layer. Me, mesophyll tissue, Pa., parenchyma cells, Vb., vascular bundles and Xy., xylem vessels. (All Plates x = 50)

in Sahel-1 cultivar with gamma-rays dose of 250, 350 and 450 Gy (Plate A, 8, 9 and 10). The previous results could be attributed to the effect of gamma – rays doses on the shape and size of the epidermal cells which could be reflected on their thickness.

Mesophyll tissue of flag leaves of the four examined wheat cultivars appeared to be composed of 3-4 layers of parenchyma cells. This result was true on both irradiated and unirradiated plants (Plate A, 1-20). The parenchyma cells of mesophyll tissue were strickly differ in their shapes and size with less or more intercellular spaces between cells.

The mostly evident effect of gamma-rays treatment on the mesophyll tissue and cells in the four examined wheat cultivars, appeared to be mainly depending on the sensitivity of each cultivars to various doses of gamma – rays. Therefore, different anatomical aspects on shape, size, arrangement and intercellular spaces between mesophyll tissue parenchyma cells were observed. Gamma-rays treatments at lower dose (150 Gy) resulted in more compactness of mesophyll tissue parenchyma cells as observed in Sahel-1 cultivar (Plate A, 7), or more regular shape of parenchyma cells as in Sids-1 and Giza- 168 cultivars (Plate A, 2 and 17). However, in Sakha-93 cultivar, the parenchyma cells of mesophyll tissue appeared loosely arranged, rounded in shape and with large intercellular spaces between cells (Plate A, 12).

The mostly appearent effect of increasing gamma-rays doses from 250-450 Gy was observed on cell walls of mesophyll tissue parenchyma cells, which appeared lighter and thin as observed with 250 and 350 Gy of gamma-rays in Sakha-93 (Plate A, 13 and 14)) and Giza 168 (Plate A, 18 and 19) cultivars. The higher dose of gamma-rays (450 Gy) resulted in bigger size and swollen shape of mesophyll tissue parenchyma cells with degenerated cell walls as observed in Sakha-93 (Plate A, 15) and Giza 168 (Plate A, 20) cultivars. This result was completely differ in Sids-1 and Sahel-1 cultivars, whereas a compactness and pressed mesophyll tissue parenchyma cells (Plate A, 5 and 10) was observed . These observations could find a possible approach to explain the reduction or enhancement in thickness of mesophyll tissue as recorded in Table 1.

Photometric analysis of mesophyll tissue revealed differences in response of different wheat cultivars to various doses of gamma irradiation (Fig. 1). Such response could be attributed to the various effects observed on the shape, size, arrangement and intercellular spaces between parenchyma cells in mesophyll tissue (Plate A, 1-20).

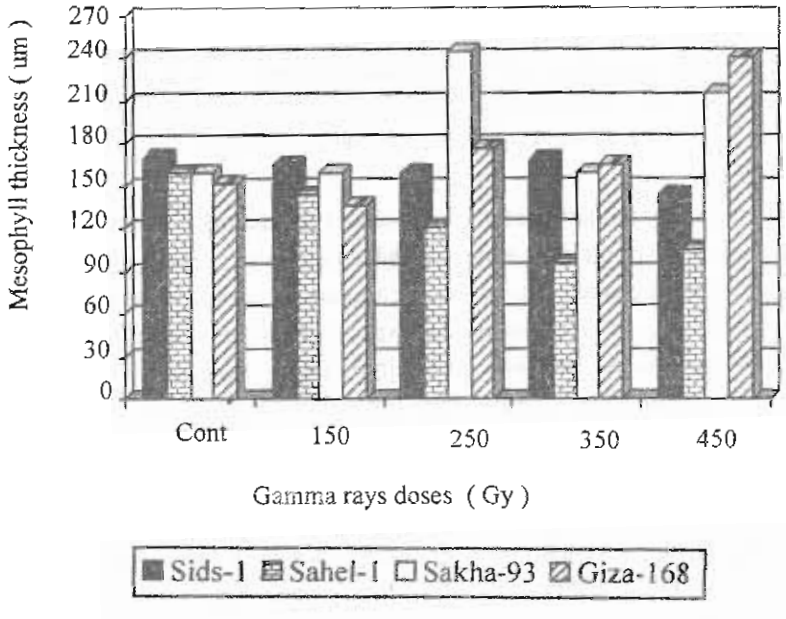


Fig.1. Effect of gamma irradiation on mesophyll tissue thickness of four Egyptian wheat cultivars .

The data presented in Fig. 1 showed that, all doses of gamma-rays were reduced thickness of mesophyll tissue as presented in Sids-1 and Sahel-1 cultivars and this response reach its maximum effect by increasing the dose used of gamma-rays from 150-450 Gy. This result was in complete accordance with data obtained by Azer (2001), who concluded that, seed germination percentage as well as seedling height, survival of seedling and dry weight of seedling were decreased by increasing gamma-rays dose in Sakha-69, Gemmiza-3 and Sids-1 wheat cultivars. On the other hand, increasing irradiation dose from 250-450 Gy enhanced mesophyll tissue thickness on both Sakha-93 and Giza-168 cultivars. The previous results could be due to the differences in radio-sensitivity between wheat cultivars as reported by Yi-Huying *et al.* (1995).

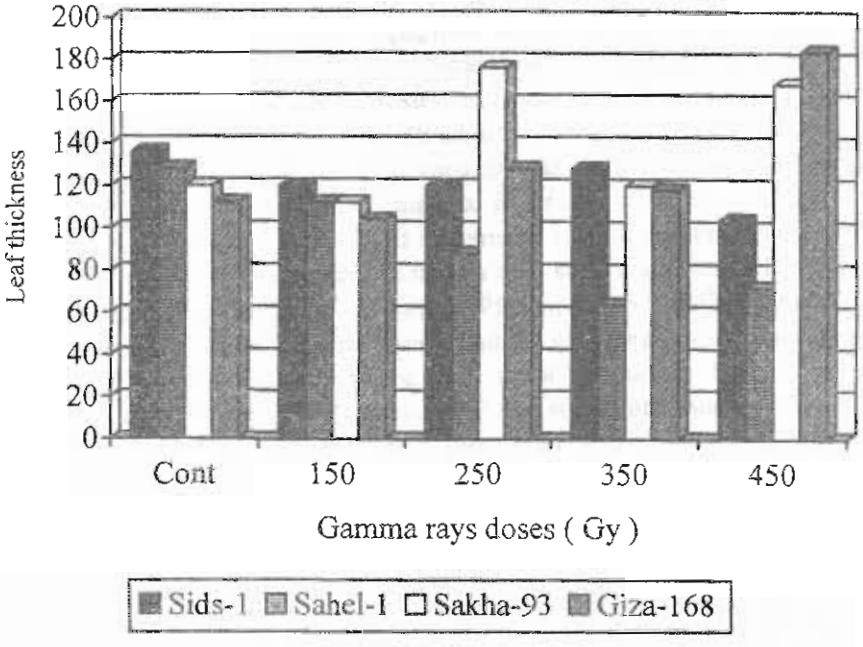


Fig.2. Effect of gamma irradiation on leaf thickness of four Egyptian wheat cultivars

Whole leaf thickness/cross-section were enhanced or inhibited as a result of induction or reduction occurred on various leaf tissues mainly mesophyll tissue. This type of results were clearly illustrated in Figs.2 and 2. Therefore, increasing gamma rays doses from 150 – 450 Gy were decreased leaf thickness/cross-section as recorded in Sids-1 and Sahel-1 cultivars (Table 1) and comparing to their control. Whereas, increasing gamma-rays doses from 250 to 450 were increased leaf thickness in Sakha-93 and Giza-168 cultivars. Such results were corresponded with the increase or decrease occurred on the thickness of the Abaxial and Adaxial epidermal cells and mesophyll tissue as presented in Fig. 1 and 2.

The data presented in Table, 1 and (Plate A, 1-20) revealed that, gamma-rays irradiation not only affected upper and lower epidermal cells and mesophyll tissue but also induced variability on shape and size of flag leaves vascular bundles components. Such response was clearly observed with 350 and 450 Gy gamma-rays in Sids-1 cultivar (Plate A, 4 and 5) and at 250 Gy of gamma-ray in Sahel-1 cultivar (Plate A, 8). This effect could be resulted from various responses *i.e.*, compactness, pressed, hypertrophy, swollen and disruption occurred on different leaves tissues. Therefore, both width and length of vascular bundles in leaves transvers-sections were affected as presented in Table, 1.

From the above mentioned resulted it could be concluded that, whole leaf thickness/cross-section as well as mesophyll tissue thickness were depressed with all doses of gamma-rays as detected in Sids-1 and Sahel-1 cultivars (Fig. 1 and 2). Alternatively, an evident increase in the thickness of the flag leaves tissues have been observed in Sakha-93 and Giza-168 cultivars. However, neither of these changes was directly correlated with the change in the number of mesophyll tissue layers which still constant. These responses were only due to the enhancement or reduction occurred on shape, size and intercellular spaces of mesophyll tissue parenchyma cells as well as thickness of the epidermal layers. In this regard, Nor-Arevyan *et al.*,1985 reported that, the chromosomes might be the primary sits of damage in irradiated seeds and this damage expressed at the metabolic and cytological levels and appears as growth retardation and chromosomal aberration. Shov and Golubkova (1963) showed that, exposure of several plants to U.V. irradiation changed the size and density of chloroplasts, the size of grana and size and number of osmophillic granules in the chloroplasts.

Effect of gamma irradiation on stem anatomical structure of some Egyptian wheat cultivars :

Stem transverse-sections of the fourth internodes of the four examined wheat cultivars showed that, stem epidermal layer was consists of one layer of epidermal cells. Whereas, beneath the internal side of epidermal layer a 3-4 layers of smaller and tightly packed sclerenchymatous cells (Plate B, 1-20). Gamma-rays treatments resulted in both reduction and stimulatory responses on the thickness of the stem sclerenchymatous layers of the four wheat cultivars (Table 2), with no observable response on the number of sclerenchymatous cell layers. Such effect could be resulted from alterations occurred on the ground tissue cell and layers, hollow pith cavity as well as normal unequal extension of sclerenchymatous layer at the ground tissue.

The ground tissue composed of 8-9 layers of parenchyma cell as detected on both Sahel-1 and Sakha - 93 cultivars (Plate B, 6 and 11). However, 7 - 8 layers of parenchyma cells were recorded on Sids - 1 (Plate B, 1) cultivar and 9-10 layers on Giza-168 cultivars (Plate B, 16). The parenchyma cells of ground tissue were adversely differ in their shape and size (Plate B, 1, 6, 11 and 16).

The data presented in Table 2 and plate B, 1-20 clearly demonstrated that, gamma-ray irradiation not only affected shape and size of ground tissue parenchyma cells, but also increased or decreased their number of layers. Generally, thickness of the ground tissue was decreased in response to gamma-

rays treatments, except treatment with higher dose of gamma-ray (450 Gy), which increased thickness of the ground tissue on both Sakha-93 and Giza-168 cultivars, respectively (Fig. 3). This response was mainly due to the enhancement of both size and number of ground tissue parenchyma cells (Table 2). On the other side of view, the same dose of gamma-ray resulted in maximum reduction on the thickness of the ground tissue in Sids-1 and Sahel-1 cultivars respectively. These findings could presented possible approach to the effect of gamma-rays on primary tissues differentiation and development.

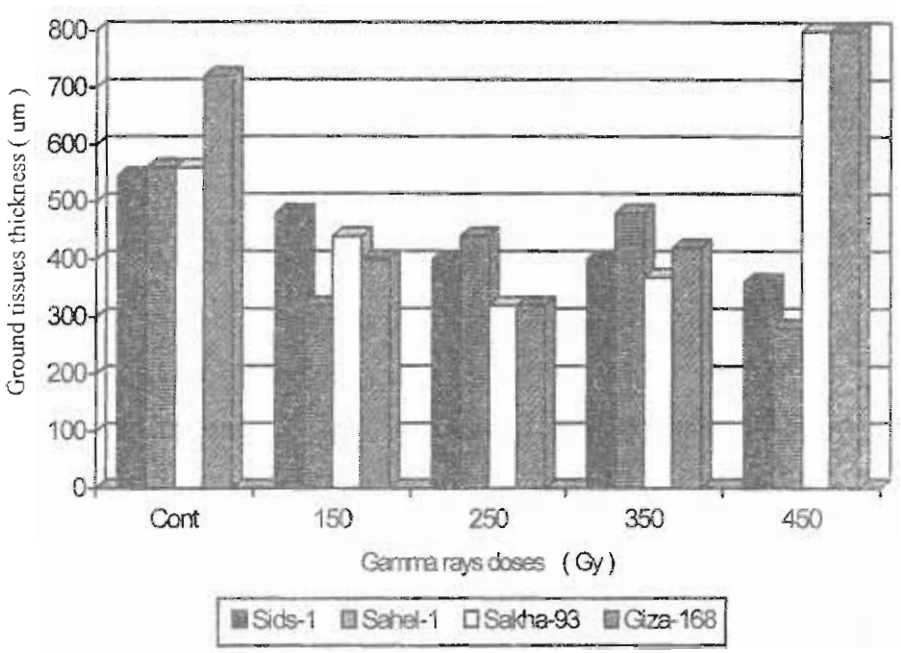
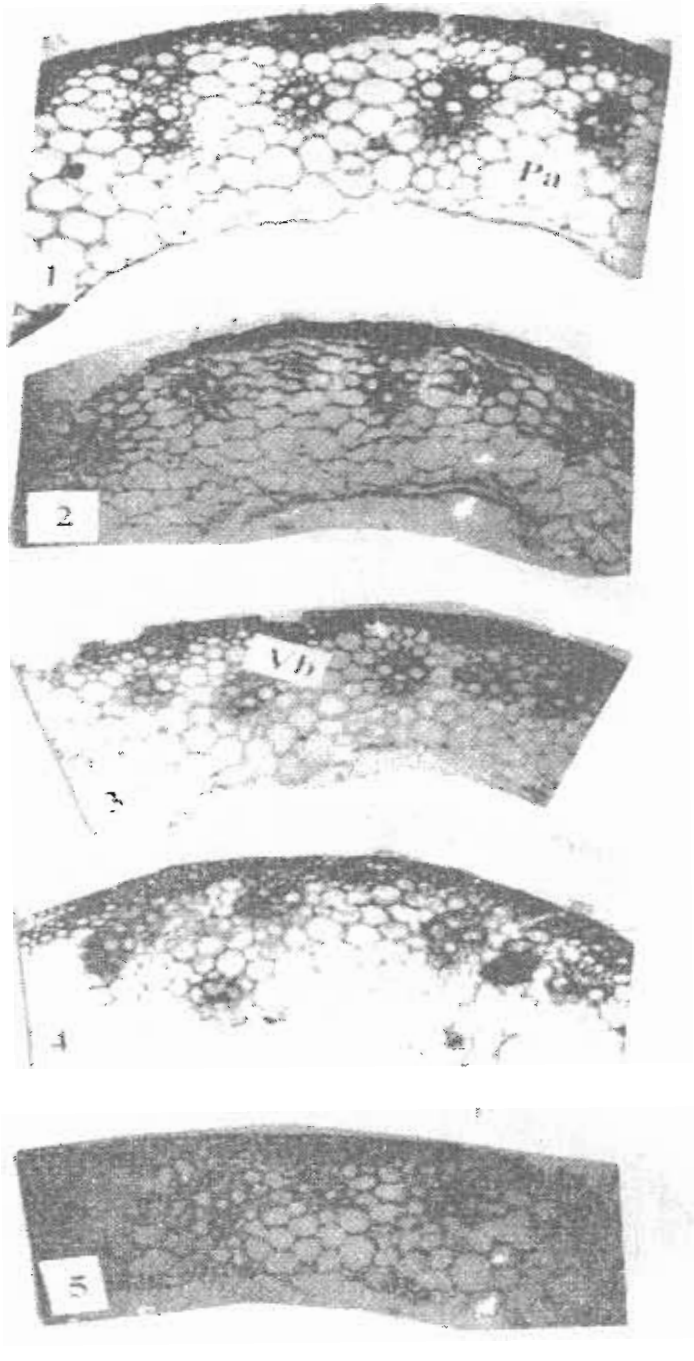


Fig. 3. Effect of gamma irradiation on ground tissues thickness of four Egyptian wheat cultivars .

Vascular tissue of the stem cross-sections appeared to be composed of closed vascular bundles arranged as separated vascular bundles with a different external bundle sheath of thick walled sclerenchymatous cells (Plate B, 1-20). As a result of gamma-ray treatments, no valuable change on number of vascular bundles/cross-section was resulted. Therefore, no significant responses were obtained for these characters between control and treatment in all studied genotypes with all doses of gamma-rays. However, dimension measurements of both width and length of vascular bundles showed clear differences between irradiated and unirradiated plants (Table 2), this could be due to the differences in the area occupied by various vascular tissues such as phloem and xylem.

TABLE 2. Effect of of gamma irradiation on stem anatomical structure of four Egyptian wheat cultivars.

Characters and thickness (µm)		Sclerenchymatous layer		Number of ground tissue layers		Vascular bundles			
						Length		Width	
Wheat genotypes and Gamma rays doses (Gy)		Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE
Sids-1	control	70.00	1.155	8.00	0.577	227.00	1.528	152.00	2.082
	150	75.00	1.732	6.00	0.577	175.00	1.155	136.00	2.309
	250	60.00	1.155	6.00	0.577	153.00	2.082	134.00	2.082
	350	57.00	2.082	6.00	0.577	163.00	1.732	141.00	0.577
	450	58.00	1.732	5.00	0.577	141.00	1.732	137.00	2.517
Sahel-1	control	45.00	1.732	9.00	0.577	143.00	2.517	134.00	2.646
	150	52.00	1.155	8.00	0.577	123.00	2.082	122.00	2.309
	250	44.00	2.309	8.00	0.577	141.00	1.528	143.00	2.309
	350	51.00	1.528	8.00	0.577	164.00	2.309	141.00	0.577
	450	45.00	1.732	6.33	0.667	120.00	2.887	124.00	2.309
Sakha-93	control	43.00	0.577	8.00	0.577	121.00	1.732	151.00	2.646
	150	40.00	1.155	8.00	0.577	142.00	1.155	150.00	2.887
	250	50.00	1.155	6.00	0.577	163.00	2.082	152.00	3.055
	350	45.00	1.732	6.00	0.577	157.00	1.732	137.00	1.732
	450	49.00	1.000	11.00	0.577	240.00	2.309	241.67	1.667
Giza-168	control	52.00	1.155	11.00	0.577	175.00	1.732	160.00	1.732
	150	48.67	0.667	7.00	0.577	120.00	1.155	152.00	1.155
	250	44.00	1.155	8.00	0.577	159.00	2.082	148.00	2.082
	350	43.00	1.732	9.00	0.577	164.00	2.082	178.00	2.082
	450	49.00	1.732	12.00	0.577	235.00	2.646	165.00	1.155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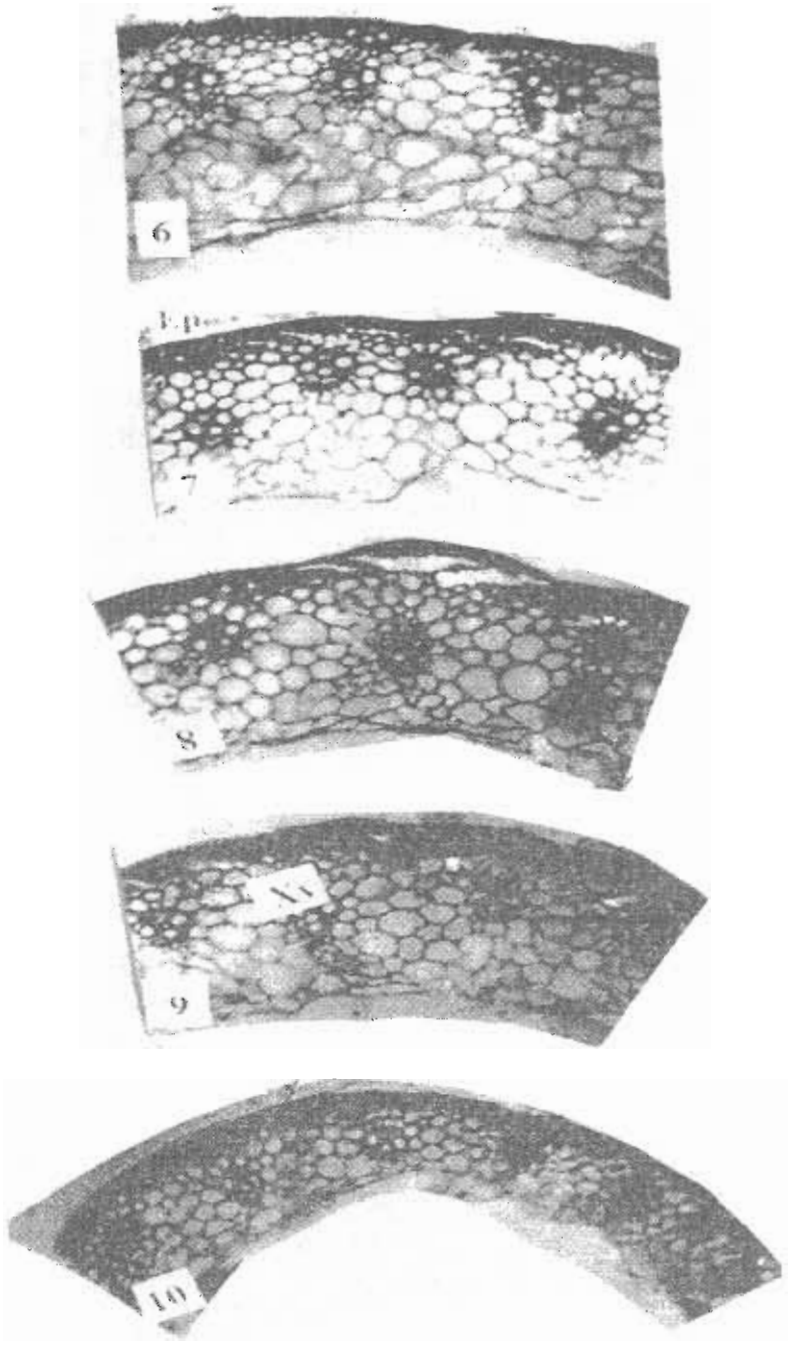
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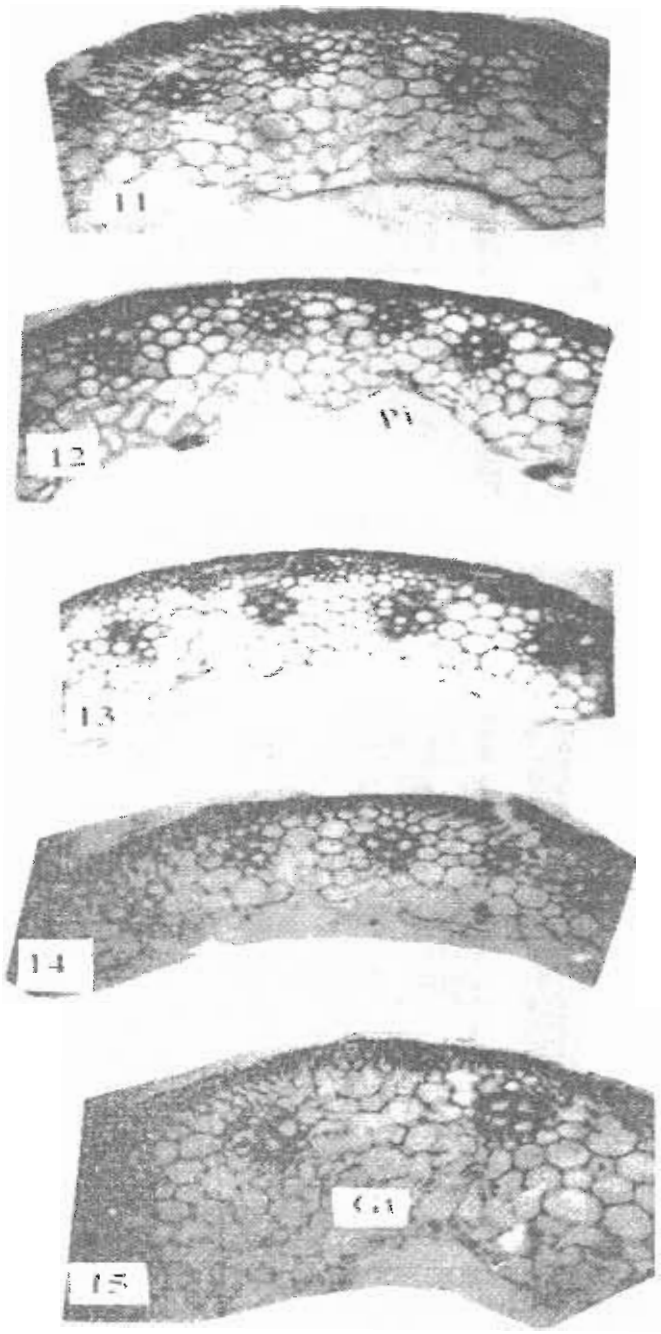
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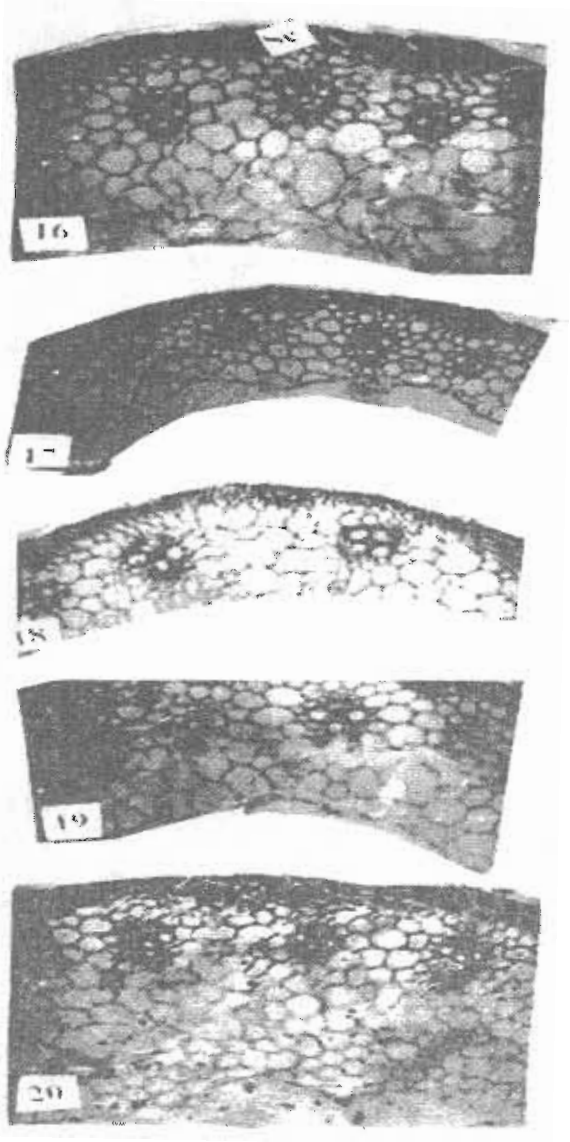

Plate B (1-20). The effect of gamma-rays treatments on the stem anatomical structure of four wheat cultivars. 1-5, Sids-1 cv., 6-10 Sahel-1 cv.; 11-15 Sakha-93 cv. and 16-20 Giza-168 cv., 1, 6, 11 and 16 control; 2, 7, 12 and 17 treatment with gamma-rays at 150 Gy. 3, 8, 13 and 18 treatment with gamma-rays at 250 Gy.4, 9, 14 and 19 treatment with gamma-rays at 350 Gy. 5, 10, 15 and 20 treatment with gamma-rays at 450 Gy. Ep. epidermal layer; Sc., sclerenchymatous layer; Gt., ground tissue; Pa., parenchyma cells and Pi., pith cavity. (All Plates x= 50)

The data presented in Fig. 4 showed that, the area occupied by hollow pith cavity were decreased with all doses of gamma-rays as detected in Sids-1, Sahel-1 and Giza-168 cultivars. On the contrary, increasing gamma irradiation dose from 250-450 Gy in Sakha-93 cultivar caused an increase in thickness of hollow pith cavity. This increase was proportion with the reduction occurred on the thickness of the ground tissue cells and layers as recorded with gamma-rays doses of 250 and 350 Gy, while at higher dose of gamma-rays (450 Gy), this increase was corresponded with the increase occurred in thickness of the different area occupied by different tissues of the stem (Fig. 3,4 and Table 2).

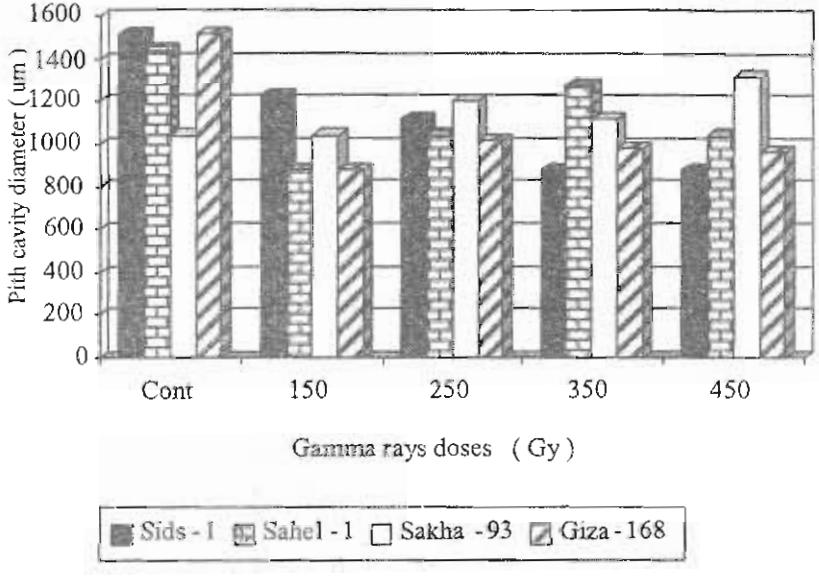

Fig.4. Effect of gamma irradiation on pith cavity diameter of four Egyptian wheat cultivars .

Generally, stem diameter/cross-section was reduced in all wheat cultivars with all doses of gamma-rays, except one treatment with 450 Gy of gamma irradiation in Sakha-93 and Giza-168 cultivars (Fig. 5).

The inhibition occurred on thickness of stem diameter/cross-section with all doses of gamma-rays in all tested wheat cultivars was associated with progressive reduction occurred in thickness of the different area occupied by various tissues i.e. sclerenchymatous, ground and vascular tissues as well as hollow pith cavity. This depression was clearly true on shape, size and number of cell layers mainly on the ground tissue. These results suggested the interference of gamma-rays in differentiation and development of stem tissues and in turn reflected on the growth and yield parameters as recorded by several investigators.

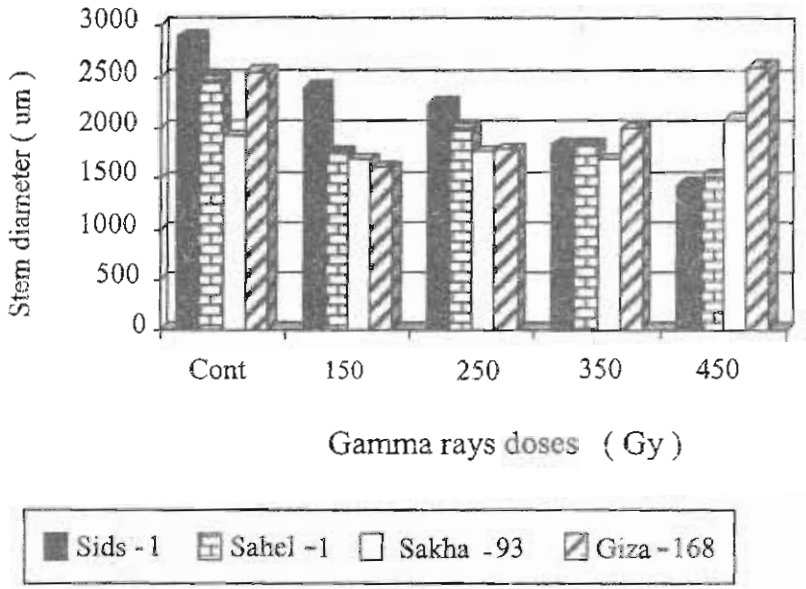

Fig.5. Effect of gamma irradiation on stem diameter/cross section of four Egyptian wheat cultivars .

Amin (2003) reported that, irradiation of wheat grains with low doses of gamma-rays (2-4 K-rad) caused increases of growth and yield parameters, while the high dose (8 K-rad) have an inhibitory effects on these traits. Azer (2001) revealed that, the percentage of seed germination, seedling height, seedling survival as well as dry weight of wheat seedling were decreased significantly by increasing the radiation dose levels from 50 to 700 Gy . He also stated that, irradiation dose less than 100 Gy induced 50 % abnormal cells for some cultivars, while 300-400 Gy needed to give such effect for some other. Furthermore, Wang Cailian *et al.* (1993) reported that, seed germination percentage and survival of rice seedling decreased with increasing irradiation dose levels over 300 Gy of gamma-rays. Also, Zagarcheva and Aleksendrova (1987) showed that, irradiation dose levels higher than 150 Gy of gamma-rays reduced the seedling growth of carrot seeds.

From flag leaves anatomical point of view, the data presented in Table 1, Fig. 1 and 2 and Plate A, (1-20) showed that, in contrast, to the reduction occurred in the thickness of the flag leaves tissues of both Sids-1 and Sahel-1 cultivars, an evident increase in the thickness of the flag leaves tissues have been observed in Sakha-93 and Giza-168 cultivars, without no observable change in the number of mesophyll tissue layers. This result means that, the influence of gamma-rays on leaves tissue was mainly depending on shape size, arrangement,and intercellular spaces between mesophyll tissue parenchyma cells.

The present investigation showed radio-sensitivity not only between wheat cultivars, but also between plant organs and tissues. Similar results were reported

by Abdel - Hady and Ahmed (2004) indicated that, the four wheat cultivars could be divided into radio-sensitive and radio-resistant, whereas Sids-1 cultivar was more resistant than the other three cultivars. Zagarcheva and Aleksendrova (1987) showed that, the crop cultivars differe from each other in radio-sensitivity. Xu-Meifen and Xu-Weijie (1986) indicated radio-sensitivity between wheat cultivars. Finally, Nor-Arevyan *et al.*, (1985) found that, the radio-resistant of some wheat cultivars might be due to the considerable increases in the content of proline, histidine, arginen and glutamin acids in the endosperm and embryos of the seeds.

From the anatomical and histological point of view, the present investigation revealed differences in radio-sensitivity not only between the four studied wheat cultivars but also between various plant organs (leaves and stems) and tissues. Therefore, depending on the level of anatomical and histological changes occurred on both leaves and stems tissues the four examined wheat cultivars could be divided into partially radio-sensitive as Sahel-1 and Giza-168 genotypes and partially radio-resistant as Sakha-93 and Sids-1 cultivars. This could be suitable for artificial selection and valuable in mutation induction programs.

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تأثير أشعة جاما على التراكيب التشريحية والهستولوجية لبعض أصناف القمح المصرية

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أجرى هذا البحث بهدف دراسة تأثير أشعة جاما على التركيب التشريحى والهستولوجى للأنسجة النباتية فى مختلف أعضاء جسم النبات (أوراق ، سيقان) لبعض أصناف القمح المصرية(سدس –١ ، ساحل –١ ، سخا–٩٣ ، جيزة–١٨٦) حيث تم تعريض حبوب تلك الأصناف للجرعات التالية من أشعة جاما (صفر ، ١٥٠ ، ٢٥٠ ، ٣٥٠ ، ٤٥٠ جراى) وقد زرعت حبوب تلك الأصناف سواء المشعة أو غير المشعة بصوبة قسم النبات بالمركز القومى للبحوث حتى عمر ٨٥ يوم حيث تم أخذ العينات التشريحية من ورقة العلم وسيقان النباتات موضع الدراسة وكانت أهم النتائج المتحصل عليها كالآتى :

- أدى استخدام أشعة جاما إلى نقص ملحوظ فى سمك ورقة العلم فى القطاعات العرضية لكلا من صنفى القمح سدس–١ ، ساحل–١ حيث كان هذا النقص متلازما مع النقص الحادث فى سمك طبقة النسيج الميزوفيلى للأوراق .
- خلافا لما سبق وجد أن استخدام أشعة جاما قد أدى إلى زيادة فى سمك القطاعات العرضية لورقة العلم فى صنفى القمح سخا–٩٣ ، جيزة–١٨٦ وقد كانت هذه الزيادة أيضا متلازمة بصورة أساسية مع الزيادة فى سمك طبقة النسيج الميزوفيلى للأوراق.
- أظهرت نتائج الدراسة أن استخدام أشعة جاما لم يؤدى إلى تغيير فى عدد طبقات النسيج الميزوفيلى للأوراق مقارنة بالكنترول وإنما كان التغير الحادث راجع إلى تأثير أشعة جاما على حجم وشكل الخلايا البارنشيمية الموجودة بالنسيج الميزوفيلى إضافة إلى تأثيرها على المسافات بين هذه الخلايا .
- أما بالنسبة للسيقان فقد وجد أن استخدام أشعة جاما بالجرعات المختلفة قد أدى إلى نقص ملحوظ فى سمك السيقان فى القطاعات العرضية فى الأصناف موضع الدراسة ما عدا مع الجرعة ٤٥٠ جراى فى صنفى القمح سخا–٩٣ ، جيزة–١٦٨ .
- أوضحت نتائج فحص القطاعات العرضية لسيقان القمح موضع الدراسة أن الزيادة أو النقص فى سمك السيقان كان متلازما بصورة أساسية مع التغيرات الحادثة فى سمك طبقة النسيج الأساسى ومنطقة الفجوة النخاعية حيث أدى استخدام أشعة جاما إلى تأثير ملحوظ على عدد طبقات النسيج الأساسى بالسيقان إضافة إلى تأثيره على حجم وشكل الخلايا البارنشيمية الموجودة بالنسيج الأساسى .
- أكدت نتائج هذه الدراسة وجود اختلاف بين أصناف القمح المصرية فى مدى حساسيتها لأشعة جاما وأن هذا الاختلاف راجع إلى وجود اختلافات فى مدى حساسية الأعضاء والأنسجة النباتية المختلفة .
- تعتبر الدراسة ذات أهمية تطبيقية فى انتخاب أصناف ذات حساسية إشعاعية مما يمكن من الحصول على طفرات بالطرق الإشعاعية .