area contains either a depression or an opening. In crossed-nicols shows strong birefringence. Diameter 11·2 μ.

Family: BRAARUDOSPHAERACEAE Deflandre, 1947

Genus: *Braarudosphaera* Deflandre, 1947
Braarudosphaera sp.
Figs. 77–78.

Material: A pentalith, Slide No. N.L.U. 98.

Horizon: Harudi Formation.

Description: Pentalith medium sized, pentagonal in shape and consists of five subtriangular segments. The tip of one of the segments is protruding out. In crossed-nicols shows strong birefringence. Diameter 11·2 μ.

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EFFECT OF GAMMA IRRADIATION ON THE ACTIVITIES OF ADENOSINE TRIPHOSPHATASE AND INORGANIC PYROPHOSPHATASE IN GRAM SEEDLINGS

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ABSTRACT

Seedling growth is inhibited by gamma-irradiation. The activities of mitochondrial adenosine triphosphatase and inorganic pyrophosphatase from cell-free preparation during early development of seedling from irradiated seeds are significantly reduced. Some disturbances in the biosynthetic pathways in irradiated seeds at later stages possibly cause the production of insufficient amount of enzymes which in turn result in reduced growth and development of such plants.

INTRODUCTION

MOST of the work on the effect of ionizing radiations in various plants is concerned with the injury that these radiations cause at the cytological level. Further, the work to establish a correlation between phenotypic effects and biochemical changes in the irradiated organisms is scanty.

Yealy and Stone[1] reported that germination of Grand Rapids lettuce seed was delayed by exposure to 100 kR gamma-irradiation. Ionizing radiations impaired mitosis resulting in reduced growth[2,3]. Presowing treatment with lower doses of gamma-irradiation (5 kR) stimulated seedling growth and an increase in the respiratory rate[4,5]. The respiratory quotient in irradiated corn wheat and sorghum, after 5–80 kR treatments, was lowered within 18 hours after beginning of water imbibition[6]. Metabolic processes like glycolysis and oxidative phosphorylation[4–7], cytochrome oxidase and catalase activities[8] were reported to be stimulated by growth inhibiting doses of radiation.

The present work was undertaken to study the effect of gamma-irradiation on seedling growth and the development of the activity of two enzymes involved in energy metabolism of the cell, adenosine triphosphatase (ATPase, E.C. 3.6.13) and inorganic pyrophosphatase (PPase, E.C. 3.6.1.1), during germination in chickpea.

MATERIAL AND METHODS

Seeds of L 144, C 214 and Hima varieties of gram (*Cicer arietinum* L.) were irradiated at room temperature with 5, 10, 20, 30 and 40 kR dose of gamma-irradiation in gammacell 900 (BARC) at a dose rate of 800 R per minute.

Germination and Growth

The seeds were soaked in 0·2% mercuric chloride solution for 10 minutes, washed thoroughly with distilled water and germinated at 25° C in the dark on moistened filter paper in petri plates, after removing the seed coat. The seeds of variety L 144 took longer to germinate. Taking elongation of embryo-axis as the criterion, it was found that the elongation in L 144 after 72 hours from removal of seed coat was comparable to that at 24 hours in the other two varieties. Thus the 'first day' of sampling for biochemical studies was 96 hr after starting the imbibition in L 144 while it was 48 hr in the other two varieties.

Measurement of ATPase and PPase Activity

Cotyledons and embryo-axis of 1–6 days old seedlings were separated, weighed (1 g each) and immediately chilled on crushed ice. The mitochondria were isolated using the procedure described by Srivastava and Sarkissian[9,10].

For measurement of ATPase activity, the reaction mixture contained 0·45 M sucrose, 5 mM KCl, 3 mM MgSO, 20 mM Tris-HCl and 1 mM ATP (substrate) in 250 ml of distilled water. The pH of the reaction mixture was 7·2. To 3 ml of reaction mixture 0·2 ml of enzyme extract was added. Reactions were carried out for 10 minutes at 37° C and then stopped by the addition of 2 ml of cold TCA. The amount of Pi was determined by the procedure of Jackson[11].

The above procedure was also used for the measurement of PPase activity but in this case the substrate used was pyrophosphate instead of ATP and instead of 0·5 ml of enzyme extract, 0·2 ml was taken. Protein was determined by the method of Lowry *et al.*[12].

Results

The data on germination of seeds are summarised in Table I. The germination in L 144 decreased with increasing doses of irradiation upto 6th day. In C 214 there was no reduction in germination while in Hima there was a slight reduction at higher doses. There was a general decrease in seedling height from Ist day to 6th day of germination in irradiated seeds (Table II). The 40 kR dose had a marked inhibitory effect on seedling height.

Height of plants at maturity were also measured (Table III). The mean height of plants from seeds treated with 5 kR and 10 kR was more than the control and it reduced as the dose increased.

The activities of ATPase and PPase from 1–6 days old seedlings of both irradiated and non-irradiated seeds were measured. There was a general decrease in the specific activity of ATPase from seedlings of irradiated seeds as compared to the control (Fig. 1).

The ATPase activity in the cotyledons as well as axis from irradiated seeds was low. It was also much more in cotyledons as compared to that in axis. The PPase activity in control and irradiated samples followed the pattern obtained for ATPase activity (Fig. 2). The PPase activities in 1-6 days old seedlings from irradiated seeds were markedly decreased as compared to the seedlings from non-irradiated seeds. The PPase activity at 40 kR was the lowest. It is evident from these results that the activities of ATPase and PPase are significantly decreased after irradiation of seeds.

TABLE I

Germination of chickpea

Data are percentages on 100 seeds

Treatment	Germination time (days)					
	1	2	3	4	5	6
L 144						
Control	0	3	22	47	76	84
5 kR	0	1	27	51	62	78
10 kR	0	2	31	49	73	81
20 kR	0	6	42	60	64	72
30 kR	0	0	19	37	52	65
40 kR	0	0	16	32	49	51
C 214						
Control	69	72	79	96	98	100
5 kR	72	79	83	91	100	100
10 kR	53	63	68	81	100	100
20 kR	46	52	62	84	96	96
30 kR	62	73	80	86	98	100
40 kR	71	81	93	96	100	100
Hima						
Control	89	93	93	100	100	100
5 kR	87	93	96	100	100	100
10 kR	87	91	96	99	100	100
20 kR	82	87	95	96	98	98
30 kR	75	81	88	92	93	93
40 kR	64	77	83	87	89	90

TABLE II

Height (cm) of seedlings in chickpea

Treatment	Germination time (Days)					
	1	2	3	4	5	6
L 144						
Control	0	1·8	2·7	6·1	7·3	7·8
5 kR	0	1·5	2·5	6·1	7·6	7·9
10 kR	0	1·6	2·5	5·6	7·1	7·6
20 kR	0	1·3	2·0	5·3	6·8	7·1
30 kR	0	0·0	2·1	5·8	6·9	7·2
40 kR	0	0·0	2·0	5·1	6·5	6·8
C 214						
Control	0·6	2·1	3·7	4·2	5·7	6·1
5 kR	0·6	1·8	3·4	4·0	5·8	6·0
10 kR	0·7	1·6	3·0	4·1	5·3	5·7
20 kR	0·5	1·6	2·8	3·7	4·8	5·3
30 kR	0·5	1·7	2·5	3·6	4·9	5·0
40 kR	0·2	1·1	2·3	3·9	4·3	4·4
Hima						
Control	0·8	1·9	2·8	3·9	5·8	5·9
5 kR	0·8	1·6	2·8	3·7	5·9	5·9
10 kR	0·7	1·3	2·5	3·3	5·5	5·7
20 kR	0·5	1·3	2·3	3·4	5·2	5·4
30 kR	0·5	1·0	2·1	3·0	5·2	5·2
40 kR	0·5	0·7	2·1	2·6	5·0	5·0

TABLE III

Growth of chickpea

Data are averages of 10 plants ± S.E.

Treatment	Height (cm), at maturity		
	L 144	C 214	Hima
Control	26·3±·6	24·7±·4	21·2± ·5
5 kR	27·7±·6	25·5±·5	22·8± ·8
10 kR	27·4±·6	24·9±·8	21·5±1·2
20 kR	26·9±·9	24·6±·9	20·9± ·4
30 kR	25·5±·6	23·6±·8	20·4±1·0
40 kR	22·9±·3	22·3±·6	18·4±1·0
C.D. at 5% level	1·66	1·33	2·70

C.D. for varieties at 5% level = 1·92.

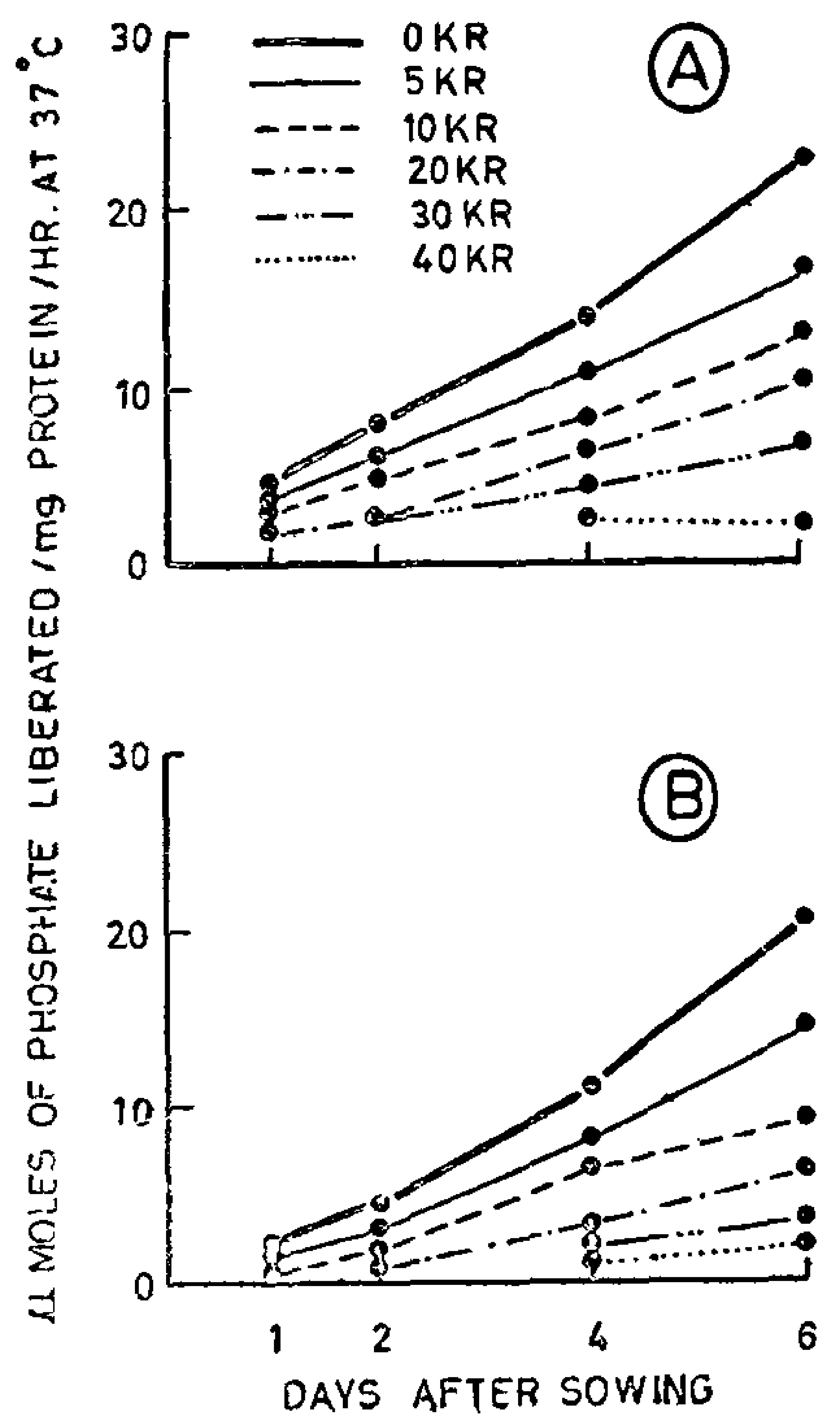

FIG. 1. Effect of gamma-irradiation on mitochondrial adenosine triphosphatase activity in chickpea seedling of var. L 144. In (A) Cotyledons, (B) Embryo-axis.

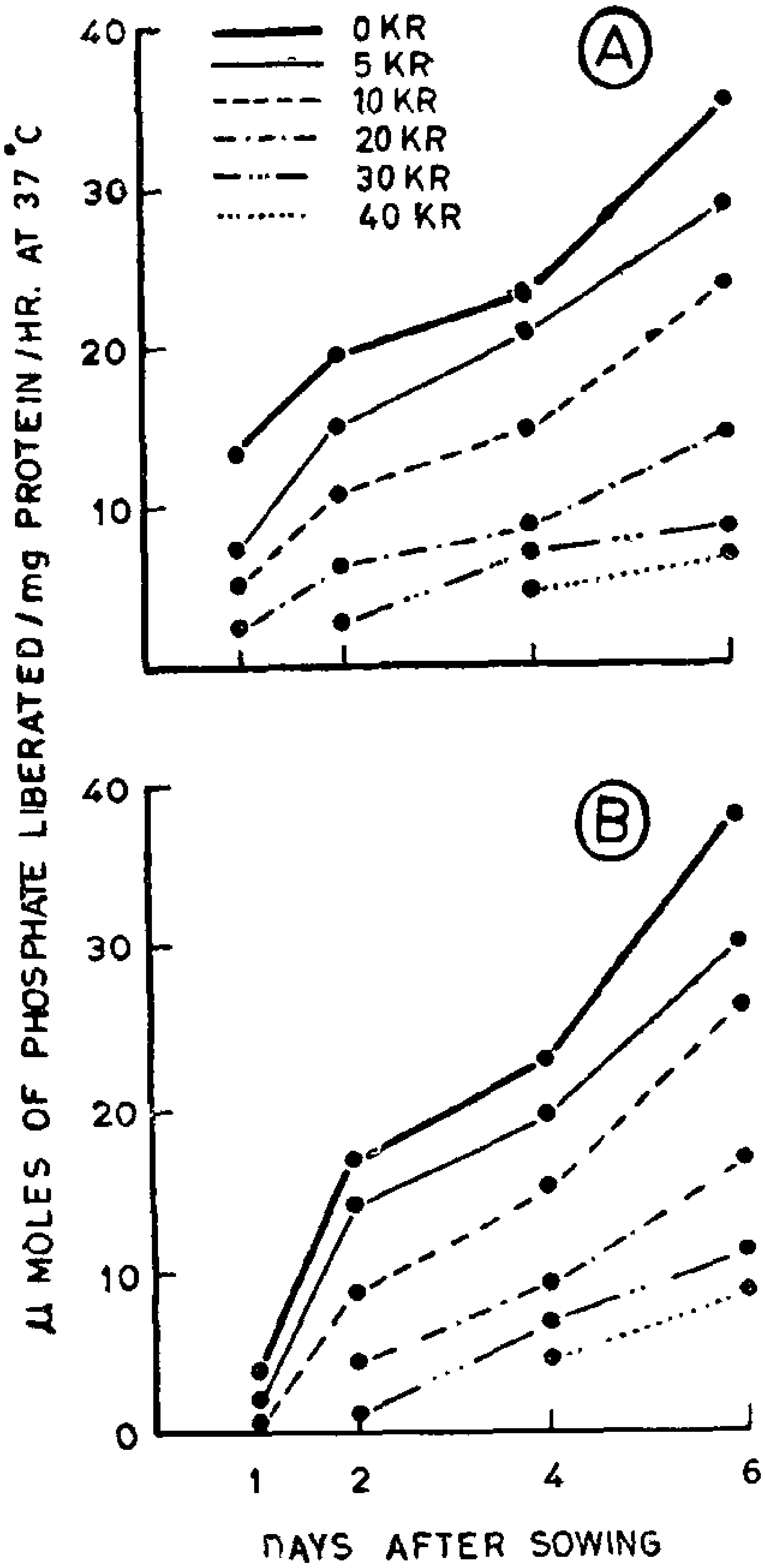

FIG 2. Effect of gamma-irradiation on pyrophosphatase activity in chickpea seedling of var. L 144. In (A) Cotyledons, (B) Embryo-axis.

DISCUSSION

Irradiated seeds show a reduction in shoot length and plant height. Reduction in plant height due to irradiation at higher doses has been reported by many investigators[13,14], as also the stimulation at lower doses[15,16].

Mitochondria are actively involved in the energy metabolism and their association with the growth and development of seedlings has been demonstrated[17]. The activities of both the enzymes studied are lowered. ATPase is an important mitochondrial enzyme since its activity represents release of energy from ATP for various cellular functions[18]. PPase also plays an important role in energy metabolism during seedling growth. It acts on inorganic pyrophosphate and releases the orthophosphate, producing energy. All the metabolic activities taking part in growth of plant seedling require energy. Present experimental results suggest some relationship between reduced growth of irradiated material and enzymes activity.

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EFFECT OF BILATERAL VASECTOMY ON TISSUE CHOLESTEROL DISTRIBUTION IN ALBINO RATS

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ABSTRACT

The tissue cholesterol distribution was studied in albino rats subjected to bilateral vasectomy. The tissues showed overall elevation in cholesterol content during early phases of vasectomy with a tendency to decline at later phases. In view of changes in cholesterol content in testis and sex accessories, possibility of modulations in their function was suggested. Liver, kidney and dorsal aorta have progressively accumulated the cholesterol content in vasectomized rats.

INTRODUCTION

THOUGH vasectomy has been accepted as a popular contraceptive device for males, a number of side effects such as degeneration of the testis, pathological changes in the epididymis, hyperplasia of the interstitial elements and alterations in androgen synthesis have been reported both in men and animals[1-2]. Since cholesterol forms a precursor for androgenesis[3] and vasectomy induces alterations in androgen synthesis[1], this contraceptive device may modulate the tissue cholesterol reserves of the animal. Since cholesterol level in the plasma is closely associated with cardiovascular disorders[4-12] it will be essential to understand the impact of vasectomy on the plasma cholesterol content in order to have an overall assessment of this popular contraceptive device. Hence the present study has been undertaken in order to understand the possible effect of vasectomy on tissue cholesterol distribution and its subsequent impact on the general metabolism of the animal.

MATERIAL AND METHODS

Wistar strain albino rats weighing 150 ± 2 g were subjected to normal (conventional) bilateral vasectomy. The operation was performed by the standard vasectomy technique[13-14] and rats were maintained in good aseptic condition for disinfection. Animals were divided into two groups and they were sacrificed on