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GAMMA RADIATION INDUCED CHROMOSOME DAMAGE IN BARLEY SEEDS RESTORED BY GIBBERELLIC ACID

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THERE are a few earlier reports that gibberellic acid (GA_3) post-treatment reduced the effects of gamma radiation on plant growth[1-3], and cytological damage[4]. In these studies[4] the concentration of GA_3 used was quite substantial (1000 ppm). GA_3 is physiologically active at very low concentrations[5], which also promote cell elongation[2] and cell division[6]. The purpose of the present study is to determine whether low concentrations of GA_3 which are adequate for stimulating cellular activities would reduce the detectable cytological damage.

Seeds of barley var. C164 with a moisture content of 9% were irradiated with gamma ray doses from 10 to 40 kR at a dose rate of 800 R/minute. The seeds were germinated in 9 cm petriplates on a single layer of Whatman's filter paper in three replicates of 25 seeds each. The filter papers were soaked with distilled water or 10 ppm GA_3 solution. Subsequently only water was added to keep the filter paper wet. After 48 hr root tips were fixed in acetic alcohol (1:3) for cytological investigations. Seedling height was recorded on the seven day old seedlings grown in Petriplates.

Anaphase bridges and acentric fragments were recorded as a measure of cytological damage. Data were recorded on about 2000 cells from a large number of roots. The percentage of cells with abnormal anaphases and fragments increased with the radiation dose but, the frequency was less in the GA_3 post-treated seeds. The difference between the control and

Table 1 *Effect of post-gamma irradiation gibberellic acid treatment on % anaphase anomalies in the root tips of barley*

	Without GA				With GA				
Dose kR	Cells scored	Bridges	Fragments	Total	Cells scored	Bridges	Fragments	Total	Difference
0	3848	0	0.05	0.05	3870	0	0.05	0.05	0
5	2405	0.08	0.66	0.74	3166	0	0.19	0.19	0.55*
10	2191	0.14	0.87	1.01	2839	0	0.35	0.35	0.66*
20	2014	1.19	0.65	1.84	2853	0.07	0.56	0.63	1.21*
30	2044	1.47	0.93	2.40	2061	0.19	0.44	0.63	1.77*
40	1807	2.21	1.27	3.48	2361	0.42	1.44	1.86	1.62*

The differences were compared by Chi-Square test. Significant differences are marked with asterisks.

Table 2 *Effect of post-gamma irradiation gibberellic acid treatment on mitotic index in barley root tips*

Dose kR	Without GA		With GA		
	Cells scored	Mitotic Index	Cells scored	Mitotic index	Difference
0	1175	7 23	1241	8.30	1.07
5	1211	7.68	1207	8 45	0.87
10	1193	8.30	892	11 88	3.58*
20	1159	7.85	903	11.63	3.78*
30	1158	8.03	895	10.73	2.70*
40	1613	5.08	946	11 63	5 45*

The differences were compared by Chi-Square test. Significant differences are marked with asterisks.

GA_3 post-treated was higher at higher radiation doses (table 1). GA_3 also increased the mitotic index, the increase being more in irradiated seeds (table 2).

Seedling growth responded to GA_3 as well as to gamma radiation, maximum growth being at 5–20 kR radiation dose in the presence of gibberellic acid. Difference between control and GA_3 was also maximum at 20 kR (table 3).

Since GA_3 was used in a very low concentration (10 ppm), it appears unlikely that it could have directly reacted with and neutralized any of the harmful products, produced in the cell due to radiation treatment. Rather, it seems more likely that GA_3 modified the cellular activity in such a way that some of the potential damage or primary damage[7] was not converted into detectable cytological damage. The effect of GA_3 thus seems to be quite different from other chemical radioprotectants such as thiols, amniothiols, DMSO etc[7,8] which are reported to be required in substantial concentrations. Also their presence is essential during irradiation for protection because post-treatment with these chemicals is not effective[9–12]. GA_3 on the other hand is effective as post-treatment and in very low concentrations.

Table 3 *Effect of post-gamma irradiation gibberellic acid treatment on barley seedling growth.*

Dose kR	Seedling height cms ± S E.		
	Without GA	With GA	Difference
0	7.96 ± 0.40	10.29 ± 0 62	2 33
5	8.57 ± 0.35	12 57 ± 0.68	4.00
10	7.00 ± 0.21	12.08 ± 0.56	5.08
20	6.86 ± 0.38	12.47 ± 0.59	5 61
30	7.31 ± 0 49	10 11 ± 0 67	2 8
40	6.46 ± 0.52	9 06 ± 0.71	2 60

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