



# INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

## Effect of X-irradiation on Photosynthetic pigments of *Salvinia molesta*(Mitchel).

Shilpi Rashmi and R .K .Sinha

Plant Physiology & Biochemistry Laboratory

Department of Botany, Patna University, Patna-800005

### Abstract:

The amount of chlorophyll a, chlorophyll b and total chlorophyll increased in all the treatments.

It was maximum at 5KR and minimum at 20KR. Chlorophyll a/b ratio was found to be lower at 5KR & 10KR and higher at 15KR & 20KR treatments over control. Chlorophyll b/a ratio was found to be higher at 5KR & 10KR while lower at higher dosages (15 KR & 20 KR) than control. Carotenoids was found to be decreased at 5KR & 10 KR and increased at 15 KR & 20 KR over control.

Ascorbic acid content increased by 2.9 folds in 5KR, 10 KR & 15 KR and 3.4 folds in 20KR treated plants.

Key words: X-irradiation, Chlorophyll, Carotenoids, Ascorbic acid

### Introduction:

*Salvinia molesta* commonly known as "African Payal," a free floating aquatic weed of paddy fields, has been selected for the present study. It reduces germination of paddy seeds and growth of paddy seedlings, thereby paddy yields by preventing light and air penetration to the soil surface.

Sinha(1997) studied the effect of x-irradiation on morphology and growth of *S molesta*. X-irradiation reduced growth in *S molesta*. Kalita and Sarma (1996) found positive correlation between growth and chlorophyll content. It was therefore considered desirable to evaluate the effect of X-irradiation on the photosynthetic pigments to analyse the survival potential of *S molesta* under x-irradiation stress.

**Material & Methods:**

Growing tips of pre-sterilized uniform inoculums of *S. molesta* were exposed to acute dosages of x-irradiation (5 KR, 10KR, 15KR & 20 KR) by Thermax x-ray machine. Exposed plants were grown in Shive and Robbins nutrient solution 1 for four weeks under light exposure of 600 lumens/sq.foot for 12 hours/day. Control plants were normal. Details of procedure has been described by Sinha (1997).

Chlorophyll estimation was done according to the method of Arnon(1949). Carotenoids were determined after Jensen & Jensen(1971). Ascorbic acid was determined following the method of Das Gupta et al (1962).

**Result and Discussion:**

Results on photosynthetic pigments are presented in Table-1. Total chlorophyll, carotenoids and ascorbic acid contents are shown in Histograms 1, 2 & 3 respectively. Chlorophyll contents was found to be higher than control in all the irradiated series. It was maximum in 5KR and minimum in 20KR. It decreased gradually with increase in irradiation dose. Price and Klein(1962) found increase in chlorophyll synthesis in x-irradiated tissues. Increase in chlorophyll content in present study might be due to increased chlorophyll synthesis or low degradation rate. At 5KR, 10KR, 15KR, 20KR it increased by 25.8%, 21.9%, 14%, 12.8% respectively. Chlorophyll content reduced gradually with increase in dose. Sprey in 1972 also found reduction in chlorophyll synthesis and grana thylakoid formation at higher doses of x-ray and gamma ray in barley leaves. The reduction in chlorophyll content might be due to less synthesis of chlorophyll. It is postulated that light dependent step in chlorophyll synthesis might be reduced at higher level but it is accelerated at lower doses of X-irradiation. All dosages of X-irradiation proved to be beneficial for chlorophyll synthesis. Ratio of chlorophyll a/b increased gradually with increase in dose. The ratio was higher as compared to control, in 15 KR and 20 KR treated plants no growth occurred while at 5 KR and 10 KR a little increase in growth occurred. Chlorophyll a increased over chlorophyll b with increase in irradiation dose. This might be due to more formation or less degradation of chlorophyll a.

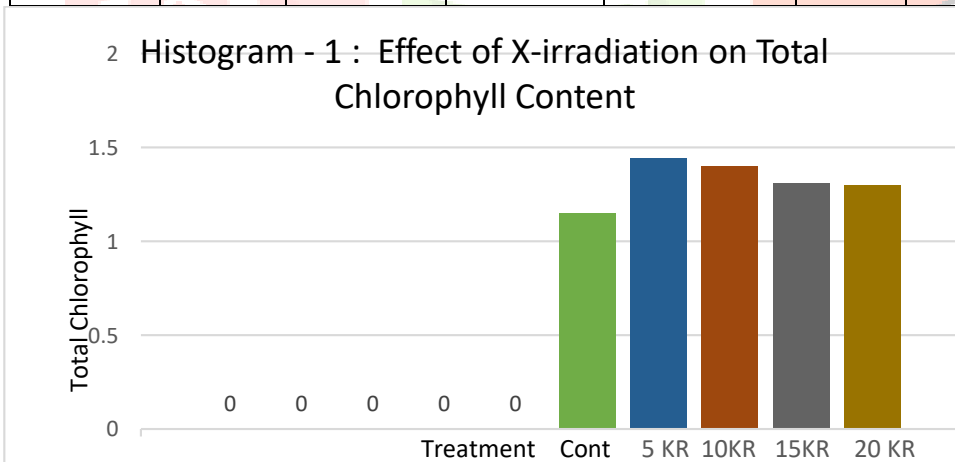
Chlorophyll b/a ratio was greater than control at lower dosages (5 KR, 10 KR) while at higher dosages (15 KR and 20 KR) it was lesser than control. Decrease in chlorophyll b/a ratio is due to less production of grana (Ryberg et al 1980). According to Lennart et al(1982) reduced grana formation occurs due to less carotenoids contents. Here carotenoids content was found to be increased with increase in irradiation dose (at 5 KR and 10 KR) it is lesser than control but at high dosages (15 KR and 20 KR) it is higher than control. This low chlorophyll b/a ratio might not be due to less grana formation. It might be due to either less chlorophyll b formation or high chlorophyll b degradation. According to Arnon et al(1956) Ascorbic acid acts as electron donor in photosynthetic electron transport chain. Ascorbic acid in the present study increases

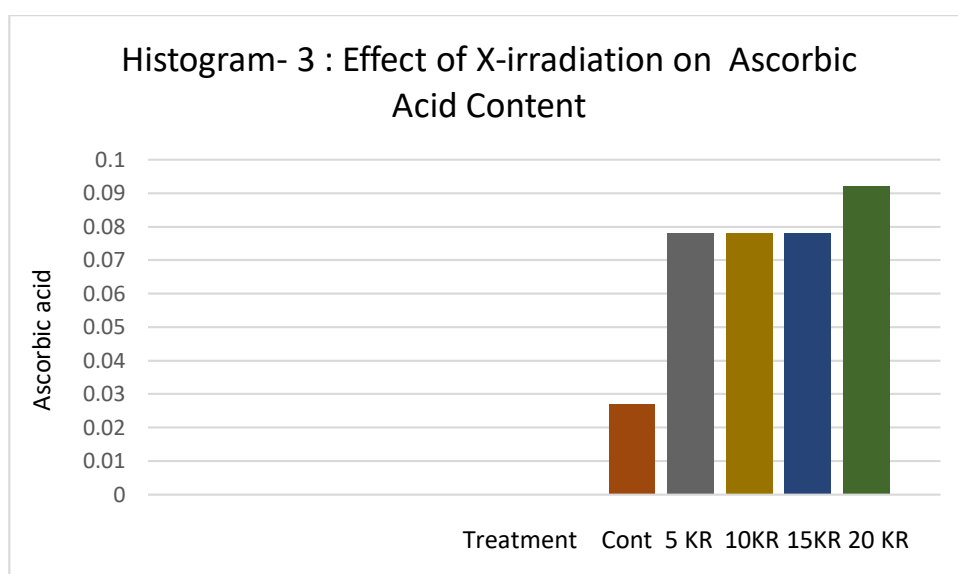
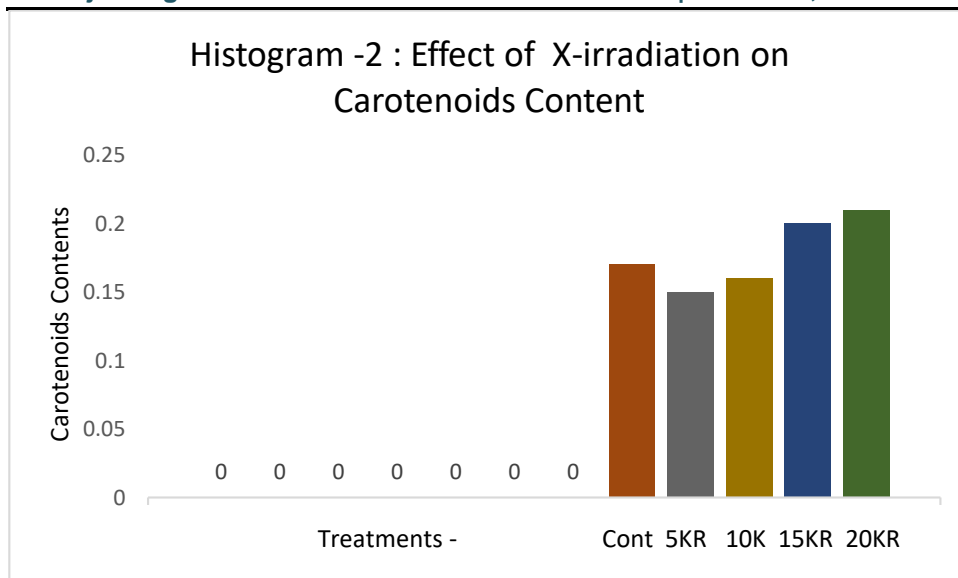
ed by 2.9 folds(approx) in all the treatments as compared to control. Singh (1974) also found increase in ascorbic acid contents with increase in irradiation dose in safflower seedlings up to 20 KR irradiation. Report on ascorbic acid affected by x-irradiation is not consistent. Jensen(1960) reported little effect on the ascorbic acid content of berry treated with 600KR. Mathur and Lewis(1961) found 40% loss of ascorbic acid in gamma irradiated mango.

Ascorbic acid content was found to be higher in all the treatments .It might be due to either increased synthesis or decreased consumption or both. Ascorbic acid is synthesized from reducing sugar (Guha & Ghosh 1935). The latter is also consumed in proliferation of new leaves. Sinha (1997) found inhibition of proliferation of new leaves .Hence increased content of ascorbic acid might be due to increased synthesis.

**Table-1 Effect of different doses of X-irradiation on Photosynthetic pigments contents(mg/g fresh weight)**

Treatment	Chl a	Chl b	Total chlorophyll	% total Chl increased over control	Chl a/b ratio	Chl b/a ratio	Carotenoids	% Carotenoids increased over control	Ascorbic acid
Control	0.59619	0.55148	1.14768		1.08	0.92	0.17		0.027
5 KR	0.73292	0.71142	1.44435	25.8	1.03	0.97	0.15	-11.76	0.078
10 KR	0.71691	0.68227	1.39918	21.9	1.05	0.96	0.16	-5.8	0.078
15 KR	0.68488	0.62396	1.30884	14.00	1.09	0.91	0.20	+17.6	0.078
20 KR	0.69365	0.60101	1.29466	12.8	1.15	0.86	0.21	+23.5	0.092





#### Acknowledgement:

Authors are grateful to HoD Botany ,Patna University for providing Laboratory and Library facilities.

#### References:

- Arnon D.I(1949): Copper enzymes in isolated chloroplasts Polyphenol-Oxidase in *Beta vulgaris* .Plant Physiology, 24, 1-15.
- Arnon D.I, Allen M.B and Whatley R (1956): Photosynthesis by isolated chloroplasts iv General concept and comparison of three photochemical reactions. Biochem .Biophys. Acta. 20,449-461.
- Das Gupta P.R, Prahlad K.V and Dhar C(Miss) 1962: Rapid method of estimation of ascorbic acid in tissues. Curr. Sci.31, 332.
- Guha B.C and Ghosh A.R (1935): Biological formation of ascorbic acid. Nature,135, 234.

- Jensen M(1960): Irradiation of berry fruits with reference to their industrial utilization. Proc.First .Nordic.Meeting on Food Preservation by Ionizing Radiation. 77-78.
- Jensen S.L and Jensen A (1971): Quantitative determination of Carotenoids in Photosynthetic tissues. Methods in Enzymology.23,586-602. Acad. Press.
- Kalita M.C and Sarma C.M (1996): Influence of zinc on green biofertilizer *Azolla pinnata*. Neobotanica, 4(2),79-82.
- Lennart A, Class Dehlin and Hans R (1982): The function of Carotenoids during chloroplast development. V. Correlation between carotenoid content ultrastructure and chlorophyll b to chlorophyll a ratio. Physiol. Plant. 55,111-116.
- Mathur P.B and Lewis N.F(1961): Storage behavior of gamma irradiated mangoes. Intern .J. Appl. Radiation.Isotopes. 11,43-45.
- Price L and Klein W.H(1962): Chlorophyll synthesis in X-irradiated etiolated bean leaf tissue. Radiat.Bot. 1,269-275.
- Ryberg H, Axelsson L,Widell K.O and Virgin H.I (1980): Chlorophyll b accumulation and grana formation in low intensity of red light. Physiol.Plant.49,431-436.
- Singh B.B (1974): Radiation induced changes in Catalase lipase and Ascorbic acid of Safflower seeds during germination. Radiat. Bot. 14,195-199.
- Sinha R.K (1997): Effect of X-irradiation on the morphology and growth of *Salvinia molesta*. Neo Botanica.5, 35-38.
- Sprey B (1972): Effect of X-irradiation on plastid differentiation in primary leaves of barley. Radiat. Bot.12,399-405.