Effect of gamma rays on chlorophyll content and ascorbic acid content of chilli in M1 generation

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Abstract
This study was performed by exposing the seeds of chilli (Capsicum annuum L.) cv. Phule Jyoti to gamma rays. The observations were made on chlorophyll content and Ascorbic acid content of chilli. The study revealed that ascorbic acid content decreased with an increase in dose/concentration of gamma rays as compared to control. Whereas in Chlorophyll content, maximum chlorophyll ‘a’ was observed in control, chlorophyll ‘b’ in lower dose of radiation and total chlorophyll in higher dose of gamma rays. Higher dose of radiation showed minimum chlorophyll ‘a’ and ‘b’ in M1 generation.

Keywords: Gamma rays, chlorophyll, ascorbic acid, chilli

Introduction
Chilli is a spice cum vegetable crop of commercial importance, characterized by tempting colour and biting pungency. No dish will fulfill without this spice in India. India is blessed with a plethora of chilli varieties which are as fresh green fruits, fresh red fruits, and dried red fruits or processed in to chilli paste, chilli powder, oleoresin etc. It is grown in several parts of India has a larger area; its productivity is very low as compared to other countries. Hence, there is an urgent need to produce and identify new varieties combining with high level of disease resistance, besides increased yield and capsaicin content in chilli.

Mutation is a sudden heritable change, brought out in a single nucleotide base pair either by addition, deletion or substitution caused by the various factors which leads to a change in the coded information finally expressed in terms of changed phenotypes through alteration in the chain of events like transcription and translation. Gamma rays are ionizing physical mutagens, capable of inducing mutation in plants and animals. Gamma rays are electromagnetic radiations, similar to X-rays in their physical characteristics and have an action on the organism. They are of very short wavelength by virtue of which they are more penetrating.

Material and Methods
The present investigation was carried out at All India Co-ordinated Research Project on Vegetable crops, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri during 2014-2015. The selected seeds of Chilli cv. Phule jyoti (15 g for each treatment) were treated with different doses of gamma rays viz. 10, 20, 30 & 40 kR at Bhabha Atomic Research Centre, Trombay, Mumbai.

Chlorophyll content (mg/g)
The chlorophyll content in leaf was estimated by adopting the procedure and extraction of chlorophyll was done with DMSO (Dimethyl Sulphoxide) method. The leaf samples weighing 0.100g were added in test tubes containing 10ml DMSO solution and kept in BOD incubator for 2 hours at 60 °C for extraction of chlorophyll. The supernatant was used for estimation of pigments. The optical density of the aliquot was measured on spectrophotometer at the wavelength of 663 nm for chlorophyll a, 645nm for chlorophyll b and 652 nm for total chlorophyll with red filter.
The chlorophyll prom leaves calculated as per Arnon (1949) equations and was expressed in mg/g.

\[
\text{OD at 652 nm} \times 100 \quad V \\
\text{Total chlorophyll} = \frac{\text{OD at 663} - 2.69 \times (\text{OD at 663} - 2.69 \times \text{OD at 645})}{100 \times W}
\]

**Where**

OD = Optical density
V = Final volume i.e. 10ml of DMSO.
W = Weight of fresh leaves (g)

\[
\begin{align*}
\text{Chlorophyll a} &= 12.7 \times (\text{OD at 663} - 2.69 \times (\text{OD at 663} - 2.69 \times \text{OD at 645})) \\
&= \frac{12.7 \times ((\text{OD at 663} - 2.69) \times (\text{OD at 663} - 2.69))}{100 \times W} \\
\text{Chlorophyll b} &= 22.9 \times (\text{OD at 645} - 4.68 \times (\text{OD at 663} - 2.69 \times \text{OD at 645})) \\
&= \frac{22.9 \times ((\text{OD at 645} - 4.68) \times (\text{OD at 663} - 2.69))}{100 \times W}
\end{align*}
\]

**Ascorbic acid content (Ranganna, 1979)**

5 ml of standard ascorbic acid solution was taken in a beaker and 5 ml of HPO3 was added to it. This solution was titrated with the dye solution to a pink colour which persisted for 15 seconds. Dye factor (mg of ascorbic acid per ml of the dye) was determined by using the formula:

\[
\text{Dye factor} = \frac{0.5 \times \text{Titre} \times \text{W}}{\text{Volume made up}}
\]

**Here**

0.5 means 0.5 mg of ascorbic acid in 5 ml of 100 ppm standard ascorbic acid solution

\[
\text{Titre} = \frac{\text{Volume of dye used to neutralize 5ml of 100 ppm standard ascorbic acid solutions along with 5 ml of metaphosphoric acid.}}{\text{W}}
\]

The ascorbic acid content was calculated by using the following formula

\[
\text{Ascorbic acid (mg/100g)} = \frac{\text{Titre} \times \text{Dye Factor} \times \text{Volume made up}}{\text{Aliquot of extract} \times \text{Weight of sample taken for estimation}}
\]

**Conclusion**

The present investigation indicated that, lower doses of gamma radiation have shows variability in the cv. Phule Jyoti for chlorophyll contents and ascorbic acid content. It needs to confirm the performance of mutants and their breeding behavior in subsequent generations.

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