Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2015, 7(3):268-271

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Effects of 2G and 3G mobile phone radiations on germination of seeds and growth of seedlings of pulses

Leena Parihar* and Pooja Mawal

Department of Biotechnology & Biosciences, Lovely Professional University, Punjab, India-

---

ABSTRACT

During the last two decades, there has been a tremendous increase in the use of wireless telecommunication devices including cell phones resulting in increase in the levels of electromagnetic field radiations in the natural environment causing electromagnetic pollution such as electromagnetic field smog. The present study was planned to observe the effects of electromagnetic radiations emitted from mobile phones on the germination of seeds, early growth of seedlings and biochemical changes in emerging seedlings of Vigna radiata (green gram), Cicer arietinum (bengal gram) and Vigna aconitifolia (moth bean). In present study it was observed that the radiations from mobile phones significantly reduced the radicle and plumule growth, fresh weight, dry weight and relative water content. The decrease in the protein content and increase in the lipid content in seedlings depending upon the period of exposure was also observed. The electromagnetic field radiations from cell phones also enhanced the activities of guaiacol peroxidases. The current study depicted that radiations from mobile phones interfere with the biochemical processes in seedlings and may affect their elongation.

Keywords: Mobile phone radiations, pulses, Biochemical activities.

INTRODUCTION

During the last two decades, there has been a widespread increase in the use of wireless telecommunication devices including cell phones resulting in increase in levels of electromagnetic field radiations in the natural environment [1]. No doubt, the enormous and indiscriminate use of mobile phones throughout the world has made our communication instant, advance and fast but along with their advantages they have raised the problems of electromagnetic pollution such as electromagnetic field smog and the risk of tissue level damage in all living organisms- humans, plants and animals. It implied a great need for assessment of environmental risk caused by electromagnetic radiations emitted by mobile phones and towers. The effects of electromagnetic radiations emitted by mobile phones have been intensely studied by scientists. Most of these studies were based on human health [2]. Mobile phones have become ubiquitous in rural areas and popular among farmers. But recent study has revealed that electromagnetic radiations emanating from them may be stunting the growth of agricultural crops and plants. Plants are continuously exposed to electromagnetic radiations in environment and hence maximum effect of electromagnetic radiations can be observed in plants [3, 4].

The present study was carried out to find the effect of electromagnetic radiations emitted from cell phones on the germination of seeds and early growth of emerging seedlings of pulses- *Vigna radiata* (Green gram), *Cicer arietinum* (Bengal gram) and *Vigna aconitifolia* (Moth bean). On the basis of frequency and difference in period of exposure of radiations to seeds the effect was noticed. In present study it was observed that the radiation from

mobile phones significantly reduces the radicle and plumule growth, fresh weight, dry weight and relative water content. Changes in amounts of proteins, lipids and activities of Guaiacol peroxidases were also observed.

EXPERIMENTAL SECTION

Chemicals and instruments

TCA (Tricarboxylic acid), TBA (Thiobarbutiric acid), Bovine serum albumin, Folin reagent, Folin and Ciocalteu's phenol reagent (2N), Sodium Tartrate, Copper Sulphate, NaOH, Na2CO3, Sodium Phosphate buffer (0.15M), Hydrogen Peroxide (0.176 M), Guaiacol (0.1M). Centrifuge (REMI Instrument Ltd. Mumbai. India), Hot air oven (Microsil India), Autoclave (NSW. India Pvt. Ltd. New Delhi).

Morphological analysis

The seeds of *Vigna radiata* (green gram), *Cicer arietinum* (bengal gram) and *Vigna aconitifolia* (moth bean) were obtained from Punjab Agricultural University (PAU) Ludhiana for experimental research work. Seeds were mainly splits into two groups- control and irradiated. Seeds soaked in DW for 8 hours. The seeds were then placed in air tight plastic boxes lined with filter paper moistened with DW. A Nokia 2690 mobile phone with frequency band 850- 1850 MHz was used to irradiate the seeds and same sample of seeds were taken as control without exposing towards radiations to compare the effect of radiations on green gram, bengal gram and moth bean. Different exposure time subjected to the seeds to check the effect of radiations like ½ hour, 1 hour, 2 hours, 4 hours and 8 hours. After this the seeds were left for germination at least for 72 hours and then further tests are conducted to evaluate the effect of radiation on seedling and compare with the control [5].

For finding the effect of variations in frequency, the other set of seeds was irradiated by the mobile phone having 3G technologies. In this set seeds were irradiated through Samsung GT B7722 with frequency band 900- 1900MHz. For performing the experiment one set of seeds were exposed to radiations and other was taken as control in which no radiations were given as in 2G. Similar procedures were followed for the biochemical investigation. The pots were watered daily for proper growth and development. One set of seeds exposed with 2G and 3G mobile phone radiation was left for germination to evaluate the in vitro morphological parameters. After 72 hour of radiations exposure, morphological analysis was done by note down the number of seeds germinated, seedling length estimation through length of plumule and radical and fresh weight was recorded by weighing all the seeds. Seedlings after fresh weight allowed drying at 70ºC for 24 h to record the dry weight. After this the relative water content (R.W.C.) of seeds is recorded by the formula- Fresh weight-Dry weight/Fresh weight *100 [5].

Biochemical Analysis

In the biochemical analysis different test has been performed which include Protein estimation test, Lipid peroxidase test and Guaiacol peroxidase test.

Lipid Peroxidation Test

Homogenization of 0.2 g of seedlings was performed by addition of 1ml of 5% TCA solution using pestle and mortar. Centrifugation of the homogenate was done at 12000 rpm for 15min. at room temperature. To the 1 ml of supernatant addition of 4ml of 0.5% TBA in 20% TCA Solution was done and after that the sample was incubated at 96ºC for 30 min. immediately the test tubes were kept in ice bath and then centrifuged at 2000 rpm for 10 min. The absorbance was recorded at 600 nm [5].

Protein Estimation

0.5ml of supernatant was transferred to a glass tube and addition of 0.7ml Lowry solution was done. After this the tubes were covered and incubated for 20 min. In the last five minutes Folin reagent was prepared. After 20 min of incubation the samples were taken out and addition of 0.1ml of diluted Folin reagent was done. Incubation was done once again for 30 minutes or longer at room temperature. After 30 minutes the sample was transferred into cuvette and optical density was taken at 750nm. Absorbance of this mixture was recorded against the BSA [8].

Guaiacol Peroxidation

The seeds sample was crushed and 50 µL of sample was taken in a test tube. To the sample addition of sodium phosphate buffer, Hydrogen peroxide and Guaiacol was done. Then incubation of the reaction mixture was done for 8 minutes. The absorbance was recorded at 470 nm [5].

Statistical analysis

Experiment was conducted with three replicates of each. Analysis of variance for morphological and biochemical parameters were performed by SPSS-16 Software.

RESULTS AND DISCUSSION

On exposing the seeds to mobile phone radiations for different periods -30 min, 1h, 2h, 4h and 8 h, it was observed that the germination is 100% in all the three seed samples of both control and all treatments. Green gram, Moth bean and Bengal gram were used for the current study. Decrease in trend was observed in plumule length, radicle length, fresh weight, dry weight and relative water content with increase in exposure time as compared to control (tables 1, 2 and 3). From the current results, it is concluded that electromagnetic radiations emitted by mobile phones negatively affect plumule length, radicle length, fresh weight, dry weight and relative water content of Green gram, Moth bean and Bengal gram. Ragha et al [6] also observed similar results in wheat and bean seeds. They found that effects of different treatments stimulate the germination and seedling vigour of plants especially in power and exposure time treatments while increase in frequency and power density has reduced the seed germination and seedling vigour. Afzal and Mansoor [5] also observed decrease in trend with increase in exposure time for these morphological parameters in Green gram. Similar results were also observed by Sharma et al. [7] in Green gram increasing the exposure time at 900 MHz band width. Akbal et al. (2010) investigated the effect of electromagnetic waves emitted from mobile phones operating at 1800MHz on germination, root growth and mitotic division of root tips of *Lens culinaris*. They concluded that germination was not affected under the specified exposure condition but root growth decreased to a possible effect of oxidative stress in the state of dormant seeds. There was also a noticeable increment in the c-mitosis is rates especially in the dormant seeds. The reasons for this increment could be problems in spindle formation.

Table 1: Morphological parameters of Bengal gram subjected to variable Electromagnetic radiation exposure times

	Plumule length	Radicle length	Fresh weight	Dry weight	RWC %
control	5.2500 a	6.7500 a	8.5100 a	2.8700 a	66.2500 a
30 min	4.7500 b	5.3000 b	7.8850 b	2.8200 a	64.2500 b
1 hour	3.7500 c	4.5000 c	7.7300 b	2.7850 a	63.9000 b
2 hour	3.4500 d	3.8500 d	7.6150 b	2.7550 a	63.8000 b
4 hour	3.1000 de	3.7500 d	7.5850 b	2.7200 a	64.0500 b
8 hour	1.8500 f	2.8500 e	4.6750 c	3.2850 a	60.1500 c

Means followed by common letter in the columns are not significantly different.

Table 2: Morphological parameters of Green gram subjected to variable Electromagnetic radiation exposure times

	Plumule length	Radicle length	Fresh weight	Dry weight	RWC %
Control	7.2500 a	3.7000 a	4.4150 a	0.5150 a	88.4500 a
30 min	6.3500 b	3.3500 a	3.7000 b	0.4900 b	86.7000 b
1 hour	5.7000 c	2.8500 b	3.2850 c	0.4650 c	85.8000 bc
2 hour	4.3000 d	2.7000 b	3.2000 c	0.4450 d	86.0500 bc
4 hour	3.4000 e	2.4000 b	2.9650 d	0.4300 d	85.4500 c
8 hour	1.9500 f	1.7500 c	1.8750 e	0.3250 e	82.6000 d

Means followed by common letter in the columns are not significantly different.

Table 3: Morphological parameters of Mung Bean subjected to variable Electromagnetic radiation exposure times

	Plumule length	Radicle length	Fresh weight	Dry weight	RWC %
Control	4.8000 a	2.7500 a	3.4800 a	0.4250 a	87.7500 a
30 min	4.2500 b	2.4000b	3.3600 a	0.4150 a	87.6000 a
1 hour	3.7000 c	2.1500 bc	3.2650 a	0.4000 a	87.6500 a
2 hour	2.6500 d	1.8500 cd	2.4850 b	0.3900 a	84.7500 b
4 hour	2.0000 e	1.6000 d	2.2450 b	0.3400 b	85.1000 b
8 hour	1.3500 f	1.1500 e	1.7500 c	0.2450 c	85.5500 ab

Means followed by common letter in the columns are not significantly different.

CONCLUSION

Seeds of Green gram, Moth bean and Bengal gram were exposed to mobile phone radiations for different periods- 30 minutes, 1 hours, 2 hours, 4 hours and 8 hours. Decrease in trend was observed for for plumule length, radicle

length, fresh weight, dry weight, relative water content and protein content of Green gram, Moth bean and Bengal gram with increase in radiations exposure time as compared to control. Increase in lipid content (MDA) and Guaiacol peroxidase (GPX) activity was observed in all the cases. From the current results, it is concluded that electromagnetic radiations emitted by mobile phones can negatively affect plumule length, radicle length, fresh weight, dry weight and relative water content of Green gram, Moth bean and Bengal gram. This reduction is associated with decrease in protein synthesis, increased lipid content and activity of Guaiacol peroxidase. The effect varied with the nature of seeds and exposure time also.

REFERENCES

[1] J Wargo; HS Taylor; N Alderman; L Wargo; JM Bradley; S Addiss. *Environment & Human Health, Inc.*, **2012**, 1-75.
[2] P Vecchia, R Matthes, G Ziegelberger, J Lin, R Saunders, A Swerdlow. *International Commission on Non-Ionizing Radiation Protection.*, **2009**, 1-392.
[3] IU Uju , PI Okwu and N Ifeagwu. *Polish Journal of Environmental Studies.*, **2014**, 23(6) 1949-1958.
[4] A Vian; D Roux; S Girards; PBonnet; F Paladian; E Devieas; G Ledoigt. *Plant Signalling Behavior.*, **2006**, 1, 67.
[5] M. Afzal; S. Mansoor. *Asian Journal of Agricultural Sciences.,* **2012**, 4(2) 149-152.
[6] L Ragha; S Mishra; V Ramachandran;, MS Bhatia. *Journal of Electromagnetic Analysis and Applications.*, **2011**, 3, 165-171.
[7] VP Sharma; HP Singh; RK Kohli; DR Batish. *Sci Total Environment.*, **2009**, 21, 5543-5547.
[8] OH Lowry; NT Rosebrough; AL Farr; RJ Randall, *J.Biol. Chem.*, **1951**,193, 265–275.