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Impact of Mobile Radiation on the Cell proliferation in *Allium cepa* and a potential antidote *Carica papaya*

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ABSTRACT: Alarming surge in the usage of electronic gadgets, especially cell phones during the wake of covid-19 pandemic can result in a rapid hike in electromagnetic radiations in the atmosphere. Unlike the thermal radiations emitted by mobile phones, non-thermal radio waves have more deleterious effect on plants and animals including human beings. However, it is a solace that nature contains a fabulous chemical diversity that yields medicines that cure and protect us. This paper is aimed to find out the effect of mobile radiation and the aqueous extract of *Carica papaya* latex on the rate of cell proliferation in *Allium cepa*. Exposure to radiation from mobile phone results in a very high mitotic index, indicating a very significant increase in the proliferation of root tip of the experimental plant. Aqueous extract of *Carica papaya* latex, on the other hand had a very significant anti-proliferative activity.

KEYWORDS: *Allium cepa*, *Carica papaya* latex, cell proliferation, Mitotic index, Mobile phone radiation.

I. INTRODUCTION

The most prevalent telecommunication in India is cell phone technology. Over the past few years, cell phone technology has flourished unbridled because of its extreme usefulness. The alarming hike in the use of electronic gadgets such as cell phones has led to upsurge in the electromagnetic radiation in the atmosphere. These have detrimental impact on all the flora and fauna.

The unprecedented growth in the number of mobile phone users has occurred in the present day of covid-19 pandemic. Lion share of the population uses mobile phones for one or other needs. As of 2020, forty crore out of the 138 crore India are students. A considerable fraction of these students are now days depending on mobiles for attending their classes which are streamed live. On an average, they are using the mobile phones for 2 hours per day. The age group of these users start from 3 years – a very susceptible and delicate period of the life span of an individual. Employees – IT professionals, teachers and many more are now working at on-line platforms. Nothing different is the case with the unemployed and uneducated lay men of this era of covid-19 pandemic, who depend on such gadgets to idle away time, since they are compelled to retreat to their own hermitage, so as to get secluded from the crowd.

II. LITERATURE SURVEY

A cell phone makes and receives calls over a wireless connection between two nodes or radio units, and is possible even while moving around far and wide. To enable this, mobile phone get connected to a cellular network furnished by a mobile phone operator, thereby allowing access to the public telecommunication network. Consequent to the increase in mobile phone usage throughout the world, the impact of mobile phone radiation on human health has turned out to be a matter of apprehension and study across the world. A fraction of the radio waves given off by a cellular phone is absorbed by the body. Governmental regulating agencies of many countries have fixed maximum levels of specific absorption rate for modern handsets. A GSM handset emits radio waves usually below a single watt. In each country mobile phone standards are set by the regulatory agencies which govern the maximum power output from a cell phone. However, signal strength as well as the power output is adjusted automatically within a certain range, in most systems to adapt to different situations, such as inside or outside of buildings and vehicles.

The mobile phones emit both thermal and non-thermal radiations. Thermal radiations comprise electromagnetic radiation in the microwave range. It only increases the temperature of matter, and never cleave molecular bonds or liberate electrons from their atoms. Non-thermal radiations or radio waves, however, have more damaging effect on both flora and fauna. Researches have shown that the effects range from a permeation of blood-brain barrier, cognitive effects, electromagnetic hypersensitivity, behavioral effects, lowering of motility as well as vitality of sperm etc. A study named REFLEX was conducted across Europe to assess the risks of possible hazards due to low energy electromagnetic exposure.² The in vitro studies conducted showed some convincing proof of damage of DNA in the cells of cultures. Though there were some indications, no crystal clear evidences were reported to support impairment to chromosomes, variations in gene activity, accelerated mitosis or such cellular changes.

All plants and animals grow by the process of cell division. Successful control of cell division – both temporal and spatial – is necessary for the proper functioning of every tissue and organ. Cancer is the uncontrolled and abnormal division of cells and results due to several causes. The most common cause is the defects or damage of more than one gene associated with cell division. After a fixed number of cell division cycles, embryonic cells stop proliferation and differentiate into adult tissue. But the cancer cells never stop proliferation and they just go on dividing.³

The fact that cancer is life threatening and because of the grave side effects associated with chemotherapy and radiation therapy, many cancer patients go for other streams of medical treatment as alternative or sometimes complementary methods of treatment.⁴ Till date, Ayurveda herbal medicine system was followed in India for anticancer treatment. In spite of all our concerns, we are fortunate enough that our planet's splendid web of life contribute innumerable gifts to humanity. We have enough for our need. In addition to being enriched with an abundance of bioactive substances, nature contains a fabulous chemical diversity that yields medicines that cure and protect us. Medicinal plants are nature's pharmacy and hence our treasure chest. Between 50,000 and 80,000 flowering plants are used worldwide for medicinal purpose^{5,6}.

Wild species of plants have been used to cure and resist diseases from time immemorial. In China, use of medicinal plants goes back to at least 4,000 years.⁷ Modern health care is unreachable to more than 80 percent of South Asia' population. Instead, they depend on traditional medicine using indigenous species. In the United States alone plant-derived anti-cancer drugs are saving not less than 30,000 lives every year.

Nearly 70 percent of all new drugs in market in the United States in the last 25 years have been of biological origin.⁸ Though technical advancements has helped in the implementation of increasingly sophisticated strategies to design medications in the laboratory, 'mother nature' is the best drug designer, ever we have ever met with.

According to David Newman, Natural Products Branch, National Cancer Institute, United States of America the chemists are making huge libraries of simple only. Unlike chemists, Mother Nature never make simple compounds. She creates compounds that perfectly dock into specific places. Taxol, a highly potent anticancer medication available in the market is one of the best examples. In due course, this became one of the best anticancer drugs available. Since the 1940s, fifty percent of all anti-cancer drugs launched are either natural products or those derived directly from natural products. But, unfortunately most of the American firms are keeping their eyes closed towards natural products as drug sources. As of now Wyeth and Merck of United States are exceptional and are the only manufacturers that still use natural products as one of their sources to look for drugs.⁹

Although predominantly known for its food and nutritional values, fruits, leaves, seeds, resins etc. of papaya plant are popular as age old and conventional medicines. The plant also provides profitable nutraceuticals. Till date some *in vivo* and a few *in vitro* studies have been carried out to assess the anti-cancerous properties of the resins exuding from papaya. Nevertheless, many indirect studies have proved the antioxidant and anti-cancerous properties of *C. papaya*. No conclusive proof has been put forward. Further research are therefore required to confirm the results of the indirect studies. Garcia Solis *et al.* have studied the effects of extracts of papaya fruit on the MCF-7 breast cancer cell viability. Based on the results, they confirmed a significant suppressive effect on the growth of mammary gland cancer cells¹⁰ and that one of the mechanism by which the inhibition is achieved by inducing apoptosis.

Present project is an effort to validate the impact of radiation emitted from cell phone on rate of proliferation of cells in the root meristem of *Allium cepa* (onion) and the latex of unripe fruit of *Carica papaya*. Rate of mitosis was studied using onion because they germinate easily without soil. Hence, the xenobiotics to which the plant is exposed can be easily controlled. Also they grow quickly and are only a few cells thick.

III. PROPOSED METHODOLOGY

Locally available small onions (*Allium cepa*) of average 4 cm long and 1.5 cm broad were selected. Outer dry scales and basal plate of the bulb was removed carefully posing little damage to the root primordia. Descaled onions were divided into three groups of ten each. They were then placed in petri dishes in which cotton soaked with distilled water is evenly kept. The experimental procedure started in the evening. Next day morning onions in all the three petridishes have just started to sprout. One of these experimental set up was now shifted to another room of the same level of the building. A mobile phone in vibration mode was placed on the petri dish. It was made to ring once in ten minutes starting from 80' clock in the morning to 8 0' clock in the night, for one day. Onions from one of the remaining two petri dishes is then placed on to another petri dish in which cotton soaked with aqueous extract of papaya resin was evenly placed. The onion in the petri dish containing cotton soaked in distilled water worked as the control. These two petri dishes were placed together in the same room which has identical atmospheric parameters as the first experimental set up. Next day early morning the root tips of length 1 mm is cut using a sharp razor blade and transferred to small bottles containing Carnoy's fluid. It is retained in Carnoy's fluid for thirty minutes for fixation and then transferred to small vials containing 70% ethyl alcohol and are refrigerated.

Squash Preparation and Observations: Slides of root tip squash was made following the procedure of Dille and King, 1983 and Dille *et.al.*(1986). ^{11,12} Six slides per group were made and two fields per slides were observed. Percentage of cells undergoing mitosis in the field under observation was calculated and is expressed as mitotic index.

Data obtained is analyzed using Student's 't' test .

IV.RESULTS AND DISCUSSION

Table 1 .Table showing the mean mitotic index in root tip cells of *Allium cepa* exposed to papaya resin and mobile phone radiation and P value of significance

GROUP	MEAN MITOTIC INDEX \pm SD*	P value denoting statistical significance of difference from control value
Control	10.939 \pm 2.114	
Root tip exposed to Papaya resin	2.349 \pm 0.523	P<0.001 **
Root tip exposed to mobile phone radiation	63.955 \pm 4.77	P<0.001 **

*Values are the mean of six different experimental observations

** P<0.001 for difference between two test group also

Squash preparations of root tips subjected to cell phone radiation showed a very large number of dividing cells which revealed an unusual mitotic activity. Mitotic index of these cells was found to be very much higher (63.955 \pm 4.77) than the control and this variation was found to be statistically significant (P<0.001). The mitotic index of the root tips from control was obtained as 10.939 \pm 2.114. Tkalea *et.al.*, (2009) studied the effect radiofrequency radiations on *Allium cepa* seeds. The results of the experiment confirmed that mitotic index increased in a dose and duration dependent manner. However, studies have also shown that both low and high doses are resulting in chromosomal aberrations.¹³ Similar results were obtained by Pesnya and Romanovsky in their studies using mobile phone exposure in *Allium cepa* model.¹⁴ The radiations released from mobile phone is proved to cause appreciable rise in the percentage of sprouting, length of sapling as well as quantity of proteins, lipid and Guaiacol in comparison to control seeds.¹⁵ Their experiments confirmed that radiations emitted from mobile phone interfere with the morphological as well as biochemical processes. Growth as well as nodule formation in the plants are also greatly affected.

However, the root tip cells from *Allium cepa* exposed to aqueous extract of latex from unripened fruit of *Carica papaya*, exhibited an extremely low mitotic index (2.349 \pm 0.523). Most of the cells were in the interphase stage. This decrease in Mitotic index was also found to be statistically significant, when compared to the control (P<0.001). The result indicates

the probable potential of the latex from unripe papaya fruits in controlling the abnormal proliferation of cells in cancers. The difference between mitotic indices of radiation exposed and papaya latex exposed was also tested using Student t test. This variation was also significant at 1% level.

Lucas, 1914 has narrated many incidents of the recovery of breast, liver or rectal cancer when administered with *Carica papaya* preparations in his book *The Most Wonderful Tree in the World—The Papaw Tree (Carica Papaia)*.¹⁶ The healing capabilities of boiled extract of pawpaw leaves against cancer have been published¹⁷⁻²⁰. That the aqueous extract of various parts of papaya are excellent remedy for the prevention, treatment or improvement of stomach, lung, pancreatic, colon, liver, ovarian, neuroblastoma, lymphoma, leukaemia and other haematological cancers has been reported by Morimoto *et al* (2008).²¹ However, there is a lacuna of thorough scientific methodologies to separate facts from anecdote.

V.CONCLUSIONS

Study conducted using *Allium cepa* model, throws light on to the role of radiation emitted from mobile phones as a potential carcinogen in higher animals, especially man, who has a very closer and direct exposure to it. But our nature contains enough of priceless and effective antidotes. The aqueous extract of the latex from unripe fruit of *Carica papaya* has proved to be a very good anti-proliferative agent.

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