MS.ID-IJPBS-5259
International Journal of Pharmacy and Biological Sciences-IJPBS™ (2025) 15 (1): 30-33
Online ISSN: 2230-7605, Print ISSN: 2321-3272
Research Article | Biological Sciences | OA Journal | MCI Approved | Index Copernicus

Effect Of Wi-Fi Router on Morphological and Biochemical Content of *Trigonella Foenum-Graecum*

Archana S Gupte*
Associate Professor, Department of Botany, G.M. Momin Women's College

Received: 22 Oct 2024/Accepted: 6 Nov 2024/Published online: 01 Jan 2025
***Corresponding Author Email:** drarchanagupte@gmail.com

Abstract
The Electromagnetic radiations impact on living organisms is a great concern along with the environment. Now days the radio frequency network has increased a lot globally. India is not an exception, with increasing number of mobile towers and smartphones. The Wi-Fi router is allow frequency electromagnetic radiation used by people on large scale. It is not possible to check the impact of this EMR on human being hence a plant has been selected which is an essential living element on the earth. A study has been undertaken to see the effects of these RF -EMR on the morphological structure and biochemical contents of *Trigonella foenum –graecum* plant. The EMR impact responded by plants with thin and short stem, a smaller number of leaves with lighter green shade, short roots, lower biochemical substances than the unexposed plants. The study concludes that the EMR emitted from the Wi-Fi router affects early growth of *Trigonella* by reducing the biochemical substances in plants.

Keywords
Trigonella, Wi-fi router, morphological, biochemical, Trigonella

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INTRODUCTION:
From last few decades, smart phones turned to be the most common form of communication. In addition to that use of internet for computers, smart TV increased, forced the living organisms into a cloud of non-ionizing radiations. The rapid use of this technology increases the electromagnetic radiations in the environment (Sharma and Parihar, 2014). Technology advancement results into the introduction of the cellular devices such as Wi-Fi routers, Bluetooth device and many more into the system in order to get good internet facility.
Many researchers tried to find out the impact of non-ionizing radiations on human being. The impact of Wi Fi routers on human health was studied by conducting survey showing females and children are more vulnerable to the EMR with higher percentage of many symptoms(Karar Hussain et al,2021).Non-ionizing radiations transmits directly electromagnetic energy, sound energy, or thermal energy without breaking the chemical bond (EPA, USA, 2012).Wi-Fi routers is a wireless device that uses RF by sending EMR with 2.4 GHz to 6 GHz operating frequency with practical range of 45 meters(Martha Srinivas et al, 2023).Many experiments were carried out on human beings, animals, but there is very less amount of literature available related to effects on plants. Short term effect EMR will not cause any effect, but long-term exposure can be dangerous (Etio Patrick Iang et al, 2017). Efforts were made by researchers to study the effect of nonionizing radiations from cell phone, blue tooth etc. on seed germination and seedling growth. Effect of magnetic field protect the Wheat plant from developing harmful changes in transpiration and photosynthetic during the abiotic stress. (M.S M

shenkaya et al, 2023). Long term exposure to high frequency field brought metabolic changes in plant (Alain Vian et al, 2016)

Trigonella foenum graecum plant was selected as a model to study the impact of the electromagnetic radiation emitted from the Wi -Fi router which is used in homes and at office places. An experiment was carried out to check whether the wi-Fi router cause any effect on vegetative characters of plant and any biochemical change in the plant living in the close vicinity. If so, in addition to it the RF of EMR could have ecological consequences causing damage to the plants.

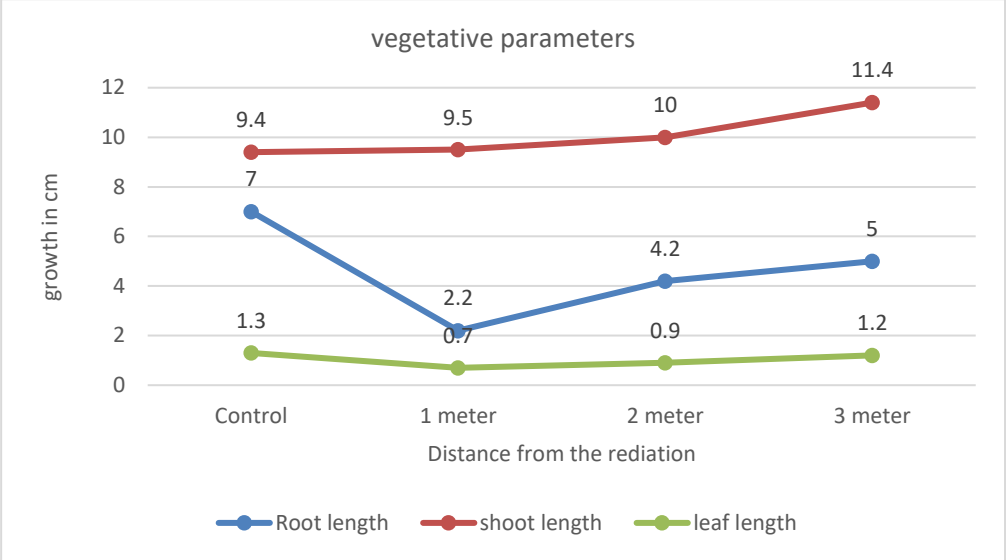
MATERIAL AND METHODS:

Seeds of *Trigonella* were bought from the Agro chem shop of the market and were sterilized with 0.1 % Mercuric chloride. Then washed with distilled water. A Wi-Fi router is placed at a distance of 1m from the beaker. The seeds were soaked in distilled water in the beaker for time duration of 4hrs, 8 hrs., 12 hrs., 24 hrs. and 48 hrs. At the maximum exposure hrs., the distance increased and kept at 2m and 3 m. The seeds were transferred into petri plate on moist sterile filter paper. Seeds were allowed to germinate. Some of the of fix number of seeds (30) were transferred into the pots containing soil. The morphological and biochemical analysis carried out after 7 days. Biochemical analysis such as Protein by Lowry's method, α amylase, Chlorophyll content was analyzed.

Results and Discussion: Plants serve as a great model for the study of the effect of EMF as they are immobile and can react immediately to the change in environment. The seeds of *Trigonella* were exposed for different period intervals and sown into the pots and maintained in the laboratory to check the effects of the EMR on morphological and biochemical substances in plants. Figure 1 seedlings of Trigonella with controlled and irradiated condition. The control plants were healthy as compared to the irradiated one.

Figure No. I *Trigonella* plants with Wi Fi Router effect

The physical observation states that the colour of the exposed seeds turned dark and were reduced in size and got shrunk as compared to the unexposed seeds. It was observed that the plants grown from the exposed seeds for shorter period of time were less vulnerable for the radiation effects. The shoot and the root system were nearly close in measure to the unexposed plants. As the period of exposer increases the shoot and the root system gets affected with maximum effect when exposed for 48hrsby Wi Fi router. Thinning of stem and reduction in root growth occur in exposed plants. Similar results were noted while studying Wi Fi router effects on Broccoli, Pea plants. (Magda Havas et at, 2016). It was observed that the increase in distance of the plants from the Wi-Fi router radiations reduces its effect and results into slight increase in length of shoot, root and leaf. (Graph No 1). The germination percentage shows slight increase i. e 77 .77 % as compared to 62.22% at 1m distance of irradiation. The radiations result into decrease in the seedling growth till the plants placed at one meter distance. As the distance increased the radiation effect slightly get decreased resulting into increase in shoot length and root length.



Graph No I: Effect of Wi-Fi router on seedling growth

According to the study, non-ionizing radiations does not cause any morphological change in *Zea mays* except the chloroplast content (Stefie et al, 2016). The leaves of the *Trigonella* were light green in color for those plants which were exposed for less period. The plants were with a smaller number of leaves as compared to control plants. As the period of exposure increases the number of leaves reduces. They were turned yellow gradually and resulted into chlorosis. The plants exposed for longer period were more vulnerable for chlorosis. The concentration of chlorophyll pigment was found to get reduced as the duration of exposure increases. Exposure to small duration does not make any drastic change in the chlorophyll content but as the period increases the amount of chlorophyll content decreases resulting into terminating the process of photosynthesis. Table No 1. Show the parameters of biochemical changes at hrs and distance dependent manner.

The metabolites such as protein content are measured in the leaf of *Trigonella* for the plants which were kept in Wi Fi router radiation. Still, it reduces from 152 mg/gm of protein in control to74 mg/gm at the maximum exposure period of radiation. It gets slight in increase as the distance of the pots increases to 2 m and 3 m. The nonionizing radiation effects were studied by researchers by taking into consideration of some other devices. Cell phone irradiation on Vigna radiata shows decrease in protein content in the roots of 7 days old plant (Ved Prakash Sharma, et al, 2009). Alfa amylase converts the complex sugar into simple. The concentration of it responsible for breaking down complex sugar into glucose, maltose etc. In present study, there was a decrease in enzyme α amylase activity. With Wi -Fi router radiation the enzyme activity decreases from 58 µg to 32 µg at maximum hours of irradiation.

Wi Fi Radiation	Chlorophyll(mg/gm)	Protein (mg/gm)	α amylase(µg)
Control	0.211	152	58
Dormant	0.15	94	38
4 hrs	0.113	126	50
8 Hrs	0.055	110	48
12 Hrs	0.137	110	42
24 Hrs	0.1	102	38
48 hrs (1 meter)	0.047	74	32
48 hrs (2 meter)	0.083	104	54
48 hrs (3 meter)	0.15	124	56

Table No I: Effect of Wi-Fi router on Biochemical contents of *Trigonella*

Cell phone irradiation cause enhancement of α amylase quantity significantly (Ved Prakash Sharma, et al, 2009). As the distance from the router increases the concentration of alfa amylase again starts increasing Table No. I. It indicates that the frequency goes on decreasing as the distance increases from the router.

CONCLUSION:

The nonionizing EMR are causing impact on the plants when they were exposed for longer period of time as compared to the short period exposure. The unexposed seeds do not show any such effect. The plants grew with regular growth with healthy leaves and shoot and root system. The vegetative parts of the exposed plants show the impact of the Wi Fi router. The plant shows smaller number of leaves and with less amount of chlorophyll indicating reduction in the process of photosynthesis which eventually responsible for death of the plant. The biochemical substances like protein and α amylase also reduced on longer exposure indicating that nonionizing EMR were impacting metabolic activity of the plants when exposed for longer duration. Plants in close vicinity gets affected more as the frequency is high near the Wi Fi router. The Wi Fi router emits EMR which affects the plants. They may cause such types of effects to other living organisms including human.

Acknowledgment:

The author is thankful to the HOD, Principal and the Management for allowing the lab work in the Department of Botany.

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