Multiple Tower Cumulative Radiation Impact on Pigments in *Achyranthus aspera*

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Abstract- The objective of this paper is to evaluate the effect of electromagnetic radiation from cell tower on the pigment contents in naturally growing plants of Achyranthus aspera which is an important medicinal herb found as a weed throughout India. The present paper gives an updated information of chlorophyll contents in the leaves of Achyranthus aspera continuously exposed by low intensity of electromagnetic radiation . The photosynthetic pigments were observed to get definitely affected by electromagnetic radiation, reducing the pigments at the closer periphery of tower mast while getting towards normalcy at distances farther away. Thus it creates imbalances on the ecosystem processes and environmental health.

Key words; Chlorophyll, Electromagnetic Radiation, Exposure, Photosynthetic pigments,Tower**.**

1 INTRODUCTION

Escalation of wireless electronic equipments like mobile phone has been raised the risk of tissue level damage for all living organisms, not only human and animals but plants as well might get affected by the same.EMF alters protein biosynthesis, enzyme activity, cell reproduction and cellular metabolism[1]. Jones [2] reported that microwave radiation caused burns along the vascular system of Zea mays seedlings , damage to the photosynthetic system and significant increase in carotenes and anthocyanins production .Chlorophyll is the principal photoreceptors in photosynthesis the light - driven process by which carbon dioxide is 'fixed' to yield carbohydrates and oxygen .While carotenoid is a class of natural fat soluble pigment where they play a critical role in photosynthetic process [3] and also protected chlorophyll from photoxidative destructions[4].

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These molecules are so sensitive that they may be altered at molecular level by the slightest response of stress developed by natural or radiations generated by man – made sources.

Plants are continuously exposed to various environmental stress and display a wide spectrum of development and biochemical responses contributing to stress adaptation, their physiological responses can be evoked by a great variety of external stimuli, including mobile phone radiation.

The present study is aimed to assess the effect of electromagnetic field from cell tower mast on absorbance efficiency of photosynthetic pigment of mature plants of *Achyranthus aspera* growing naturally in the vicinity of multiple cell towers.

2 MATERIAL AND METHODS

Leaves from plants of *Achyranthus aspera* growing at five different radial distances from cell towers were collected to have an estimation of chlorophyll and carotenoids by Spectrophotometry by DMSO method of Hiscox & Israelstam 1979 [5]. The data were compared against those obtained from control plants which were naturally growing in the

zones having no tower at least for 500m radially. The locations were Jublee Park (for control) and sakchi (for radiation zone). The distances are tabulated as follows-

Table I- Symbolizing radial distances from cell tower

Sl.No.	DISTANCES	PARAMETER
1.	Control	No tower at a place up to 500 m
2.	D1	50 m distances from cell tower
3.	D2	100 m distances from cell tower
4.	D3	150 m distances from cell tower
5.	D4	200 m distances from cell tower
6.	D5	250 m distances from cell tower

The chlorophyll contents estimated in 250 mg of crushed fresh weighed leaves in 5ml of DMSO (Dimethyl sulphoxide) and incubated at 60-65c for 20 minutes in a water bath. The absorbance for chlorophyll-a, chlorophyll-b and carotenoids from supernatant liquid at 645,663 and 480 nm against a blank DMSO cuvette was taken by Spectrophotometer and estimated by Arnon's equation (1949) [6] and Krik and Allen (1965) [7].

Chl a mg/g $= [(12.7 \times A_{663}) - (2.6 \times A_{645})] \times V/W$

Chl b mg/g $= [(22.9 \times A_{645}) - (4.68 \times A_{663})] \times V/W$

Total Chl = Chl a + Chl b

Carotenoid $= A_{480} + (0.114 \times A_{663} - 0.638 \times A_{645})$

Where

A_{663} = Absorbance at 663

A_{645} = Absorbance at 645

A_{480} = Absorbance at 480

V = Total volume of extract

W = Weight of leaf tissue in mg

3 OBSERVATION

A direct and continuous exposure of plants in EMF from cell towers resulted in gradual decrease in pigment contents from non radiation to radiation zone .The values of all the three pigments were highest at control while a regular decrease was noted from 50 m to 250 m . The extreme reduction was noted at 100 m where it got down from total chlorophyll of 0.6759 to 0.1403 mg but as the radial distances was increased away from cell tower , the pigments were recorded to have gradual increase up to 250 m and it reached to 0.3578 for chl total and 1.1923 for carotenoids .It is noteworthy that even at 250 m the values could not be attained at par with control plants as is tabulated (Table- 2). The inverse sin curve was thus obtained (Fig-1). The critical distances was 100 m for *Achyranthus aspera* as highest reduction was observed and from 150 m the values started improving slightly.

4 RESULT AND DISCUSSIONS

The observation of data certainly reveals that plants don't stay unaffected in this world of EMFr induced pollution .The heavy reduction in chlorophyll a and b must have reduced the primary productivity in exposed plants of *Achyranthus* .The heavy reduction in carotenoids from 1.8580 mg/g to 0.7739 mg/g must have shattered the photo protective apparatus of the plants as carotenoids are the biomolecules which have a critical role as photo protective compounds as these quenching triplet chlorophylls and singlet oxygen derived from excess light energy .This results in the damage of limiting membrane [8,9] The increased amount of carotenoids is usually considered as a defensive mechanism for plants. The mild thermal stress caused by EMF may be tolerated by the plants within a certain limited zone of radiation but beyond that threshold the plant loses its chlorophylls also. The natural fat soluble pigments – carotenoids play a critical role in photosynthesis apart from protecting chlorophyll molecules from photoxidative destruction[10].The lattter being principal photoreceptive molecules create a heavy loss to the

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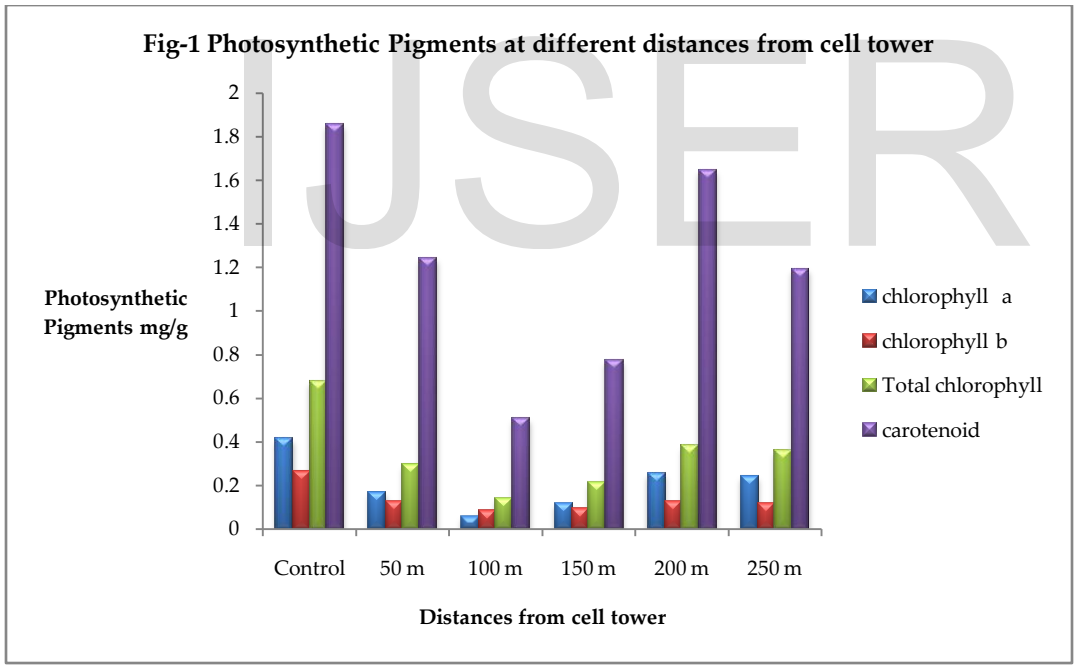
Table II - Photosynthetic Pigments at different distances from cell tower in *Achyranthus aspera*

Photosynthetic pigments (mg/g)				
Distance	Chlorophyll a	Chlorophyll b	Total Chlorophyll	Carotenoid
Control	0.4135 ± 0.09	0.2623 ±0.09	0.6759 ±0.19	1.8580 ±0.24
D1	0.1663 ±0.04	0.1273 ±0.02	0.2936 ±0.05	1.2408 ±0.23
D2	0.0564 ±0.01	0.0839 ±0.00	0.1403 ±0.02	0.5059 ±0.08
D3	0.1183 ±0.02	0.0933 ±0.01	0.2116 ±0.04	0.7739 ±0.12
D4	0.2554 ±0.03	0.1254 ±0.01	0.3808 ±0.04	1.6470 ±0.28
D5	0.2389 ±0.02	0.1189 ±0.01	0.3578 ±0.04	1.1923 ±0.20



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plant when exposed chronically for a longer duration to EMF smog. Thus it may be visualized by the observed data that the oxidative stress created by such smog could not be protected by the antioxidant enzymes present in the plants.

These observations have also been supported by Wassim Hussain, University of Toronto as he declares [11] that radiation is emitted continuously and is stronger at close quarters .On the other hand, field intensities drop rapidly with distances away from the base of transmitters because of attenuation of power with distances. And, this actually has been recorded when we observe our evaluated data upto the distances of 100 m from base station, the fall in pigments contents is highly significant but after this as the plants were taken at 150 m ,200 m and 250 m . the values slightly improved. Chen et.al [12] was of the opinion that radiations from EMF have a thermal effect as that of microwaves as he observed increase in the concentration of chlorophyll a and b on the preheated seeds of *Isatis indogotica*. Jones [13] noticed significant increase in carotenes and anthocyanins in microwave irradiated maize plants.

Cell towers wavelengths have a significantly higher frequency then even radiowaves which could actually destroy the chemical and molecular bonds of biochemical structures thereby leading to reduced amount of chlorophylls and carotenoids near to the base tower. This may be interpreted as reduced enzymes action responsible for the synthesis of pigments as was observed by Dr. R. K. Kohlion *Phaseolus aureus* [14].

5 CONCLUSION

Many towers erected at nearby areas, i.e. within a range of a kilometer leads to cumulative damage in the tissues but can take years and even decades to show up in the morphology. But the biomolecules are so sensitive that they may be altered at molecular level which can be represented only on the biochemical analysis of plants.

Therefore, overlapping of high radiation fields by creating multiple towers within a short distance range of 1 km should be completely avoided since the EMF may increase the combined radiation of all towers in an area.

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