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Effect of High Tension Line on the Biological Activity of Phytochemicals in *Mustard (Brassica juncea)* Seeds

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ABSTRACT

In Recent times high frequency non-ionizing electromagnetic fields are increasingly rapidly in the environment. These electromagnetic fields are responsible for a genuine environmental stimulus which able to evolve specific responses in plants that share many similarities with those observed after a stressful treatment. The mechanism of this interference between EMF and plant tissues is not clearly understood. The present study investigated the effect of non-ionizing radiations on mustard (Brassica juncea) seeds. The influence of high tension line (HTL) of 220 kV on the nutritional value of mustard were determined by quantifying ash, moisture, carbohydrate, protein, fat, fiber and minerals. The antibacterial activities of mustard seeds crude extract were determined against S. aureus, E. coli and Bacillus subtilis.

Keywords: Bacillus subtilis, Chemical composition, E. coli, HTL, Mustard, Radiations, S. aureus.

I. INTRODUCTION

A magnetic field is an inescapable environmental factor for plants on the Earth. High frequency electromagnetic fields (HF-EMF) are increasingly present in the environment because of active development of technology, including high voltage transmission lines, cell phone and various devices. In the case of high-voltage transmission lines, [1] the EMF can extend to about 300 meters. Power line EMF is strongest directly underneath the power lines [2] and gradually decreases away with increasing distance. By increasing population of the world, towns are expanding and many buildings are constructed near high voltage overhead power transmission lines [3]. The increase of power demand has increased the need of transmitting huge amount of power over long distances. Large transmission lines configuration with high voltage and current levels generate large values of electric and magnetic fields stresses which affect the plant [4-7] and the nearby objects located at ground surfaces. Radiation interception by a crop is directly affected the biomass production of a crop. Therefore it is essential to investigate the effects of electromagnetic fields near the transmission lines on crops [8-11].

Mustard is an annual herb with seedlings that emerge rapidly, but grow slowly. Plants cover the ground in 4 to 5 weeks with favorable moisture and temperature conditions. The tap roots will grow 5 ft deep into the soil under dry conditions, which allows for efficient use of stored soil moisture [12-14]. Plant height at maturity varies from 30 to 45 in. depending on type, variety, and environmental conditions. Mustard is a cool season crop that can be grown in a short growing season. Varieties of yellow mustard usually mature in 80 to 85 days whereas brown and oriental types require 90 to 95 days [15-18]. Seedlings are usually somewhat tolerant to mild frosts

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after emergence, but severe frosts can destroy the crop. Mustard especially the brown and oriental types, has a partial drought tolerance between that of wheat and rapeseed. Moisture stress caused by hot, dry conditions during the flowering period frequently causes lower yields [19-23].

Studies showed that some phytochemicals are affected badly by HTL while some remained unaffected and some affected slightly.

II. MATERIAL AND METHODS

II.1Collection of samples and extraction

Mustard seeds were collected several distances (0m, 5m, 10m, 15m and 20m) from 220kV HTL in Hanumangarh district (Rajasthan). That seeds were washed with tap water, dried and then crushed. Extraction was carried out in soxhlet with different solvents i.e. methanol, petroleum ether, Triton X-100 and water. After filtration, dried and concentrated under vacuum, the crude extract was stored in refrigerator [24].

II.2 Determination of antibacterial activity

Antibacterial activity of mustard seed extracts have been evaluated by disc diffusion method [25].

II.2.1 Treatment of glass apparatus and its sterilization

All glass apparatus including petridishes were cleaned by using chromic acid and then washed with distilled water. The washed apparatus were wrapped in inert foil and kept in an oven for 6-8 hours at 120°C for sterilization.

II.2.2 Preparation of the media and its sterilization

Both nutrient agar and nutrient broth are used for the culture media of the bacterial cells. The constituents of nutrient agar medium in one liter (L) are as follows:

1. High veg Peptone - 5 gm
2. High veg extract No. 1 - 3 gm
3. Agar - 15 gm
4. Distilled water - 1 L (pH = 6.8±0.2)

The constituents of nutrient broth in one liter (L) are as follows:

1. High veg Peptone - 5 gm
2. High veg extract No. 1 - 3 gm
3. Distilled water - 1 L (pH = 6.9±0.2)

In order to prepare the cultural media of nutrient agar all the components except agar were dissolved 500 ml of distilled water with gentle warming whenever required. The agar was dissolved in the remaining distilled water by heating and constant stirring. Thereafter both of the solutions were mixed and heated to obtain a homogenous solution. This solution was filtered through a cotton cloth to obtain a clear solution. Nutrient broth was prepared directly by dissolving the given quantity in one liter of distilled water. For the sterilization of the cultural media i.e. the solutions of both nutrient agar and nutrient broth were plugged in the conical flasks and autoclaved at 120°C and 15 lbs pressure for 30 minutes [26-27].

II.2.3 Pouring of the media into sterilized petridishes and its solidification

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After the sterilization 15-20 ml of nutrient agar was poured homogenously into sterilized petridishes and these media containing petridishes were kept ajar until they dried and solidified. Thereafter they were used for inoculation.

II.2.4 Inoculation of the media with the test organisms

The bacterial cells were inoculated to the media containing petridishes with the help of sterile loop or spreader. For incubation these petridishes were kept in incubator for 16-18 hours. Bacterial culture was prepared by the inoculation of bacterial cells into the nutrient broth at room temperature then it was kept for incubation in laminar for 10-15 minutes.

II.2.5 Preparation of test plates

After incubation of cultural broth for few hours, these inoculums were spread uniformly over the agar surface by sterile cotton swab. Then filter paper discs soaked in test samples were placed on these petridishes. Thereafter sample containing petridishes were kept in incubator for 24 hours at 37°C.

II.2.6 Measurement of zone of inhibition

Zone of inhibition of each sample was measured individually after 24 hours of incubation. The zone of inhibition indicates the efficacy of sample, which is region around the sample where the growth of microbe is inhibited. Larger the zone of inhibition, more the susceptibility of microbe towards the sample and vice versa.

II.2.7 General method used for the determination of antimicrobial activity

After the solidification of nutrient agar the loan of test organism (i.e. *Escherichia coli, Staphylococcus aureus and Bacillus subtilis*) was applied on the surface of cultural media. Different extracts of mustard seeds were taken as samples for investigation. An isolated disc was soaked in each sample for 20 minutes and then placed on bacterial loan applied petriplates. These petridishes were kept in incubator for 24 hours at 37°C. After 24 hours petridishes have been removed from incubator and zone of inhibition have been measured in mm.

III. OBSERVATIONS

Following observations were recorded during the study:-

Table: Biological investigation on the extracts of mustard seeds under 220kV high tension power line [HTL]

Plant seeds extract medium	Distance from high tension power line	*Bacillus subtilis*	*Escherichia coli*	*Staphylococcus aureus*
1%Triton X-100	0 meter	Nil	Nil	Nil
	5 meter	Nil	Nil	Nil
	10 meter	Nil	Nil	6mm
	15meter	7mm	Nil	Nil
	20 meter	6mm	Nil	6mm
	Control	22mm	Nil	14mm
Petroleum ether	0 meter	Nil	Nil	8mm

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	5meter	Nil	Nil	6mm
	10 meter	Nil	Nil	7mm
	15 meter	7mm	Nil	Nil
	20 meter	8mm	Nil	Nil
	Control	8mm	Nil	Nil
Methanol	0 meter	Nil	Nil	Nil
	5meter	Nil	Nil	Nil
	10 meter	Nil	6mm	Nil
	15 meter	Nil	Nil	6mm
	20 meter	Nil	Nil	Nil
	Control	Nil	6mm	6mm
Water	0 meter	Nil	Nil	Nil
	5meter	Nil	Nil	Nil
	10 meter	2mm	1mm	3mm
	15 meter	2mm	3mm	2mm
	20 meter	4mm	3mm	3mm
	Control	Nil	Nil	Nil

IV. CONCLUSION

Results showed that HTL affects the phytochemicals of mustard plant and due to adverse effects of HTL the amount of biological active phytochemicals decreases in plant hence lesser activity is observed. As the distance from HTL increases the biological activity of different extracts also increases. The extraction in micellar medium shows the highest antibacterial activities as compared to other extracts.

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