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Response of UV-B Radiation on Germination Percentage, Growth Pattern and Chlorophyll Content at seedling stage of *Capsicum annum* L.

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Abstract- *Capsicum annum* L. (Syn: Capsicum frutescens L., family: Solanaceae) is an herbaceous spice plant cultivated in tropical and subtropical conditions in different countries of the world. In India it is commonly known as "Lal Mirch". The present study deals with response of UV-B radiation on different growth parameters of capsicum crop. Plants were grown in the field and exposed to supplemental UV-B radiation (280-320nm) for 1 hr and 3hr regularly supplied by the sunlamp, 300 watt from sowing till seedling stage. The total UV-B irradiation received by the plants from the lamp was 24.23 $Jm^{-2}s^{-1}$. The seed germination percentage was significantly decreased by 1 hr and 3 hr UV-B irradiation. The exposure of 1 hr UV-B irradiation showed promotory response on chlorophyll content and biomass of plumule and cotyledons while exposure of 3 hr of UV-B irradiation showed inhibitory effect on growth and chlorophyll content of seedlings. Current findings suggest ways to increase crop yield to cope the adverse effect of abiotic stress.

Index Terms- *Capsicum annum*, UV-B radiation, seed germination, chlorophyll Content etc.

I. INTRODUCTION

Capsicum annum (Chilli) was originated in the Latin American region and Guatemala as a wild crop. Chilli crop is a very simpler crop to cultivate. It can survive on different soil types and several climatic conditions. But the best output of this crop is obtained when it is grown on deep, loamy, fertile soil with appropriate moisture content. The soil is ploughed properly at the time of planting of the crop. It has a short duration period of 3 to 4 months. The largest producer of chillies in the world is India accounting for 11 lakh tons of production annually followed by China with a production of around 4 lakh tons. Foods containing peppers, especially chili peppers, often have a strong aftertaste due to the presence of capsinoids in peppers. Capsaicin, a chemical found in chili peppers, creates a burning sensation once ingested, which can last for several hours after ingestion. The green chillies contain vitamin C (134%), A (7%), B6 (10%), Ca (1%), Fe (1%), Carbohydrate (1%), dietary fibre (6%), K (5%), Mg (2%) etc. Capsicum is used for various problems with digestion including upset stomach, intestinal gas, stomach pain, diarrhea, and cramps. It is also used for conditions of the heart and blood vessels including poor circulation, excessive blood clotting, and high cholesterol and preventing heart disease. Other uses include relief of toothache, seasickness, alcoholism, malaria, and fever. It is also used to help people who have difficulty swallowing. Some people apply capsicum to the skin for pain caused by shingles, osteoarthritis, rheumatoid arthritis, and fibromyalgia. It is also used topically for nerve pain (neuropathy) associated with diabetes and HIV, other types of nerve pain (neuralgia), and back pain. Capsicum is also used on the skin to relieve muscle spasms, as a gargle for laryngitis, and to discourage thumb-sucking or nail-biting. Some people put capsicum inside the nose to treat, hay fever migraine headache, and sinus infections (sinusitis). One form of capsicum is currently being studied as a drug for migraine, osteoarthritis, and other painful conditions. Abiotic stresses are serious threats to agriculture and result in the deterioration of the environment and of crop loss worldwide, reducing average yields for most major crop plants by more than 50% (Wang et al., 2003). During the last few decades, the depletion of stratospheric ozone layer increased due to increase of different pollutants in environment. Under conditions of normal healthy growth, plants possess a number of enzymatic and non-enzymatic detoxification mechanisms to efficiently scavenge either the active oxygen species (AOS) themselves or their secondary reaction products (Bartling et al., 1993). Since flavonoids and phenolics absorbed UV-B bands they represent a selective UV-B filter which protects plant tissue against harmful rays (Rozema et al., 2002). Perusal of literature reveals that no much work on Capsicum affected by supplemental UV-B radiation has been done. The present study aimed to assess the response of supplemental UV-B (280-320nm) radiation on seedling growth of *Capsicum annum* (L.) crop.

II. MATERIAL AND METHODOLOGY

Seedling growth study:

Seeds of *Capsicum annum* were collected from Noida district of Uttar Pradesh. Seeds were selected uniformly and surface sterilized with 0.1% $HgCl_2$ for one minute, thoroughly rinsed with distilled water and allowed to germinate in field and exposed with supplemental UV-B radiation for different time periods i.e. T_1 (control), T_2 (1 hr treatment) and T_3 (3 hr treatment). For further growth study, germinated seeds were irradiated daily with supplemental UV-B radiation for varying durations as above followed daily up-to seedling stage of the crop. Seedlings were dissected in radicle, plumule and cotyledon

for growth measurements. Different growth parameters viz. length, fresh and dry weights were measured and compared with control.

Method of (Odum, 1960) was adopted for growth pattern studies. The mean values with ±SD of three seedlings from each plot were calculated, represented in the results with the help of SPSS 15.0 software.

Seed germination (%):

The germination percentage was calculated by following formulae:

$$\text{Germination \%} = \frac{\text{Number of seed germinated}}{\text{Total number of seeds plotted}} \times 100$$

Chlorophyll Estimation:

250 mg fresh leaves were homogenized with 80% acetone, centrifuged at 4000 rpm, for 5 minutes. Filtrate was taken out and final 10 ml volume was made by using 80% acetone. Optical Density was read at 645, 652 and 663 nm with the help of Systronics 105 spectrophotometer. The chlorophyll content was estimated by the formulae given by Arnon, (1949) which are expressed below:

Chl. 'a' mg/g =12.7 (D663) – 2.69 (D645) x V/1000 x W
Chl. 'b' mg/g = 22.9 (D645) – 4.68 (D663) x V/1000 x W
Total chl. mg/g = D 652 x 1000/34.5 x V/1000 x W

There were three replicates used for the chlorophyll estimation study and mean values with ±SD of each plot were calculated, represented in the results with the help of SPSS 15.0 software..

III. RESULTS AND DISCUSSION

In the present study, the data given in table and figure (1, 2, 3 and 4) showed that seed germination percentage was decreased maximum 31.03% by 3hr supplemental UV-B exposure while 16.69% by 1hr supplemental UV-B exposure as compared to control. Siddiqui *et al*., (2007) observed the same results they observed that seed germination decreased with increased supplemental UV-B radiation in soybean (*Glycine max* L.) crop whereas Hong *et al.,* (2008) observed that enhanced UV-B radiation did not affect seed germination in the common alpine grass species. Length of radicle was inhibited maximum 25.61% by 1hr treatment while in plumule maximum inhibition observed 26.79% by 3hr treatment of supplemental UV-B radiation. The fresh weight of radicle, plumule and cotyledons was declined maximum 30.76%, 44.44% & 23.52% by 3hr supplemental UV-B radiation respectively. Dry weight of radicle declined maximum 33.33% by 1hr and 3hr treatment while dry weight of plumule and cotyledons increased maximum 100% & 25% by 1hr and 3hr of supplemental UV-B radiation. In present investigation, length of seedlings was increased consistently to supplemental UV-B doses however fresh weight and dry weight of seedlings promoted inconsistently to supplemental UV-B doses. Whereas no significant difference was observed by Zhao *et al.,* (2003) in *Gossipium hirustum* and Tapia *et al.,* (2010) in cucumber (*Cucumis sativus* L.) seedlings fresh weight and dry weight when grown under ultraviolet radiation. However, Hong *et al.,* (2008) in alpine grasses and Farokh *et al*., (2010) in *Catharanthus tinctorious* observed a decrease in seedling height, fresh weight and dry weight of different plant species under different supplemental UV-B radiation. The present results revealed that chl a, chl b and total chlorophyll promoted 4.52%, 14.92% and 7.31% by 1hr treatment while decreased 3.29%, 11.19% and 5.85% by 3hr supplemental UV-B radiation respectively when compared with control. Similar findings were also reported by Strid *et al.,* (1990) in *Pisum sativum*; while Jain and Goyal, (1985) in *Cucumis utillissimus;* Sharma *et al.,* (1988) in *Pisum sativum* observed significant reduction in different chlorophyll pigments by supplemental UV-B exposures; but Deckymn and Impens, (1995) reported enhancement in chlorophyll content in *Phaseolus vulgaris* L. The present study indicated that short duration of UV-B radiation showed promotary effect while long exposure proved inhibitory response on seedling growth parameters of *Capsicum annum*.

Table: Effect of suplemental UV-B radiation on seedling growth parameters of *Capsicum annum* L.

Parameters	Supplemental UV-B radiation treatment Control	1hr UV	3hr UV
Germination %	61.22±2.113	51.00±1.732	42.22±1.922
Radicle			
Length, cm	2.643±0.660	1.966±0.288	2.366±0.152
F.W., gm	0.013±0.001	0.013±0.005	0.009±0.005
D.W., gm	0.003±0.000	0.002±0.000	0.002±0.000
Plumule			
Length, cm	1.366±0.416	1.60±0.173	1.00±0.264
F.W., gm	0.009±0.002	0.009±0.000	0.005±0.000
D.W., gm	0.001±0.000	0.002±0.000	0.002±0.000
Cotyledons			
Number.	2.00±0.000	2.00±0.000	2.00±0.000
F.W., gm	0.017±0.007	0.017±0.003	0.013±0.001
D.W., gm	0.004±0.000	0.005±0.000	0.005±0.000

Chlorophyll Content			
Chl a	0.243±0.001	0.254±0.001	0.235±0.000
Chl b	0.134±0.005	0.154±0.002	0.119±0.001
Total Chl	0.410±0.001	0.440±0.001	0.386±0.000

F.W. = Fresh Weight, **D.W.** = Dry Weight, **cm** = Centimeter, **gm** = gram, **±** = Standard Deviation

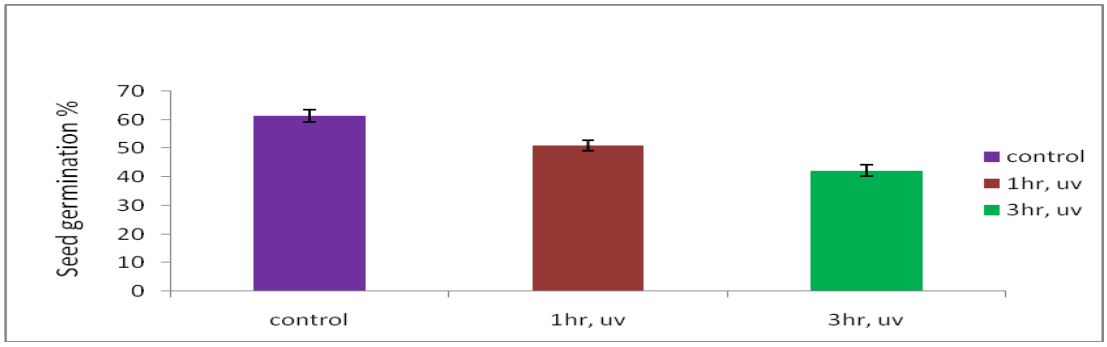


Fig.1. Effect of suplemental UV-B radiation on seed germination percentage of *Capsicum annum* L. Data represents mean value and vertical bars represents ± S.E.

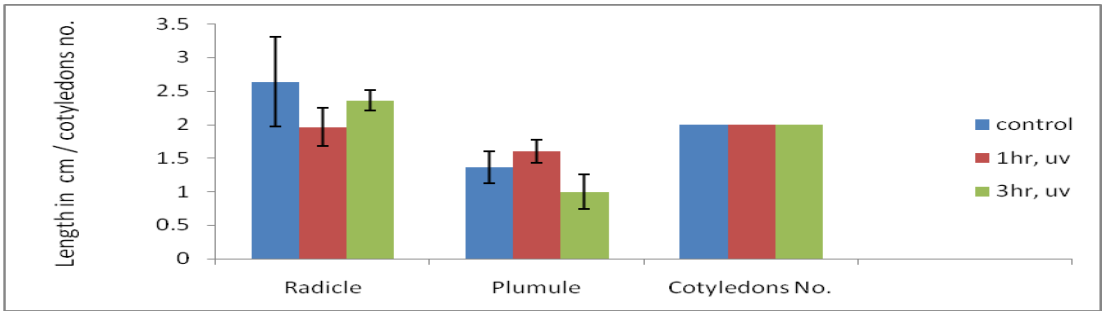


Fig.2. Effect of suplemental UV-B radiation on seedling length of *Capsicum annum* L. Data represents mean value and vertical bars represents ± S.E.

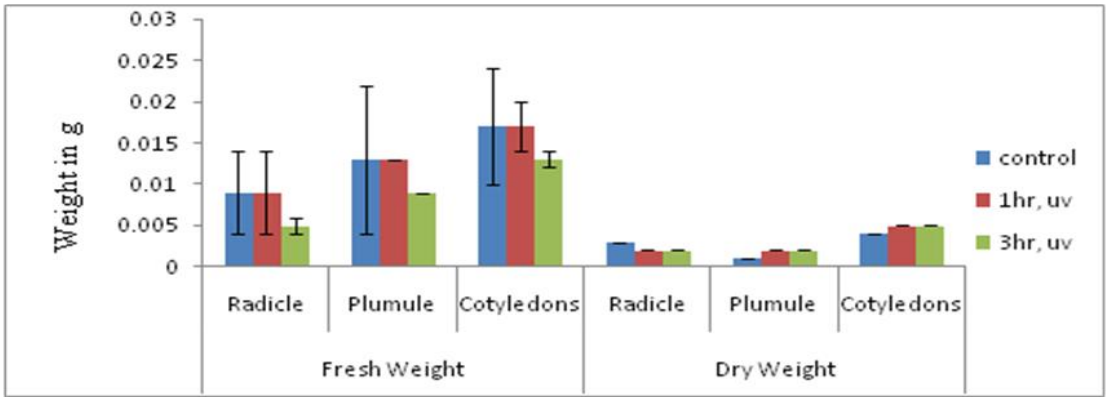


Fig.3. Effect of suplemental UV-B radiation on fresh weight and dry weight of *Capsicum annum* (L.) seedlings. Data represents mean value and vertical bars represents ± S.E.

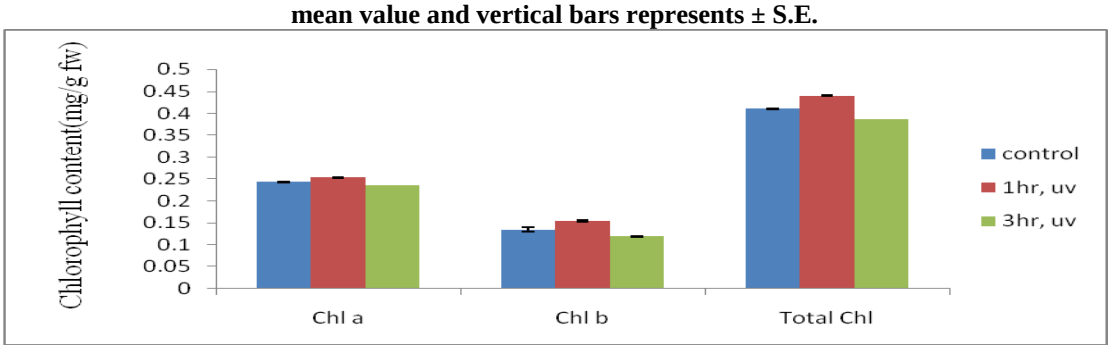
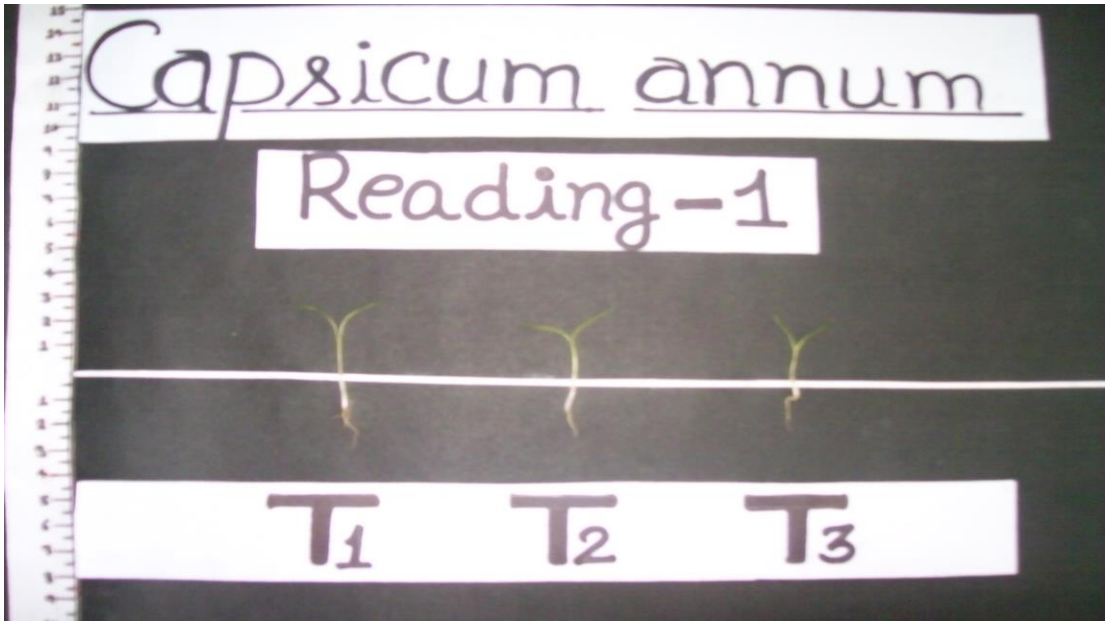


Fig.4. Effect of suplemental UV-B radiation on seedling Chlorophyll content of *Capsicum annum* L. Data represents mean value and vertical bars represents ± S.E.



Plat: Morphological comparison of germinated seedlings of *Capsicum annum* (L.) from different treatment of supplemental UV-B radiation.

IV. CONCLUSION

From present findings it can be concluded that short duration of UV-B radiation showed promontory effect on seed germination percentage, radical, plumule and cotyledons biomass and chlorophyll content while long exposure had inhibitory effect on seedling growth parameters of *Capsicum annum* (L.). The consumption of spices is more than its production in all over the world due to rapid increase of world population. So, this technique may provide information to farmers and researchers to overcome ever increasing demand of spices by increased production of *Capsicum annum* crop.

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