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Research Article

ENHANCED SOLAR UV-B (280-320NM) RADIATION MEDIATED CHANGES ON LEAF SURFACE ANATOMY AND ESSENTIAL OILS GLANDS IN *OCIMUM BASILICUM* L.

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ABSTRACT
The anatomical ability of the *Ocimum basilicum L* growing under the enhanced solar UVB (280-320nm) radiation in field condition was analysed. This Exposure of basil plants (*Ocimum basilicum*) in an enhanced UV-B (20%) radiation for 4 h per day resulted in plants with higher dry matter and thicker leaves. Enhanced UV-B failed to have an effect on plant growth, morphology and considerably accrued trichomes and leaf thickness. Analysis of leaf surface and volatile oils glands by SEM in fresh leaf samples harvested after two or three weeks of treatment showed that UV-B radiation increased the number of oil glands compared to ambient grown plants. There was no impact on volatile oil composition.

Keywords: Ultraviolet-B, *Ocimum basilicum L*,Leaf surface Anatomy, Volatile oil glands.

INTRODUCTION
Due to the damage of ozone layer the level of UV radiation reaching the earth surface, especially UVB radiation increasing in the biosphere. Solar radiation in the UV-B range (280–320 nm) corresponds to a minor percentage of the total solar energy but it is potentially harmful because these short wave lengths are capable of causing deleterious effect in plants. Because due to lack of locomotion plants are able to face the changing environment .The high energetic UVB radiations strongly absorbed by the macromolecules like Nucleic acid and Protein and they induce the damage.

The effects of UV-B on plants include inhibited growth, morphological changes and increase in the level of secondary pigments (Sharma *et al.,* 1998; Mackerness and Thomas, 1999; Hollosy, 2002; Brzezinska *et al.,* 2006). Simultaneously, many anatomical and morphological changes were observed, like the changes in leaf optical properties alter the surface reflectance which can affect the amount of UV-B radiation reaching underlying tissues (Cen and Bornman, 1993). Epidermal leaf hairs (trichomes) modify the microenvironment of the leaf, primarily through extension of the boundary layer and a reduction in water loss (Ehleringer, 1984). They can also reduce the amount of UV-B radiation that penetrates through the epidermis (Karabourniotis *et al.,* 1992), probably due to their UV-absorbing pigment compounds (Karabourniotis *et al.,* 1992, 1994).

The *Ocimum basilicum* plant is green perennial shrub that grows naturally in most tropical countries in India. The leaves are highly aromatic, can be used to flavor foods and beverages. This plant constitutes a variety of natural bioactive compounds. This species produces essential oils, reported as an valuable in vitro antimicrobial natural molecule against fungi and bacteria (Khare *et al.,* 2010). Though, information on UV-B mediated changes on leaf surface and quantity of oil glands in *Ocimum basilicum L* is scanty. This study is quite interesting, informative and of innovative approach.

Therefore, the objective of this study was to examine the effects of enhanced UV-B radiation on whole plant morphology with specific focus on the changes in surface anatomy of leaf and volatile oil glands. We hypothesize that predicted increases in UV-B radiation will alter the surface increase thickness and leaf trichomes and enhance the quantity, number and size of the volatile oil glands content.

MATERIALS AND METHODS

***Plant materials*:** Certified seeds of of *Ocimum basilicum* L. obtained from the Agriculture Department, Madurai were sown in experimental plots in Madurai Kamaraj University**,** Botanical Garden. One set of plants was grown under ambient solar radiation and other under 20% UV-B enhanced solar radiation.

***Plant growth and UV-B treatment*:** The seeds were soaked overnight in running water. Separate soil beds were prepared for control (ambient) and UV-B treatment and seeds were sown in these experimental plots. The plants were watered regularly and care was taken to avoid microbial or pest infection during the experimental period. Plants with the first foliage leaf stage were used for UV-B treatment. UV-B treatment was given to these plants for 4 hours daily from 10 a.m. to 2 p.m. Treatment was continued under ambient solar radiation and 20% UV-B enhanced solar radiation supplemented by a Philips TL40W/12 sunlamp (Gloelampenfabrieken, Holland). The first formed leaves were collected at different time periods and all the physiological and biochemical analyses were carried out.

***Measurement of radiation*:** A Li-Cor Li-188B quantum/radiometer (Li-Cor., Inc., USA) with suitable photo detector was used to measure all the visible and photo synthetically active radiation. Radiation below 400 nm was determined by an IL 700 radiometer with a SEE 400 photodiode detector (International Light Inc., USA).

Leaf anatomical measurements: Morphology of leaf trichomes and quantity of oil glands was observed with a Hitachi S-520 Scanning Electron Microscope with 20kV accelerating voltage (0,1 nA) and photographed on Kodak plus-X 125 Professional film or black and white prints.

RESULTS AND DISCUSSION

The *Ocimum* plants developed some strategies against enhanced UVB radiation including morphology

Figure 1: Control-Normal Trichomes

UVB treated – accrued Trichomes

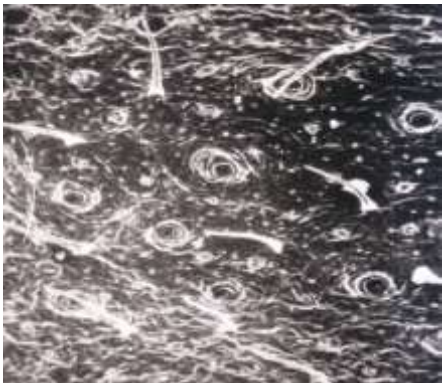
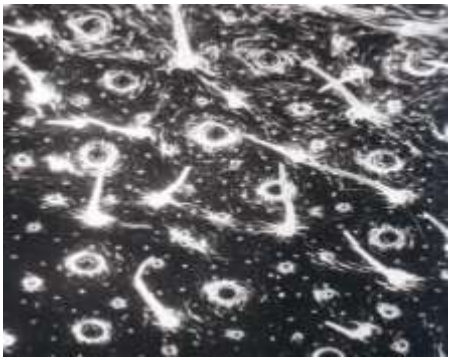


Figure 2: Control: Normal Volatile glands



UVB treated –Increased Volatile oil Glands

Plate 1: Trichomes and Volatile oil glands characteristics of leaves of 25days of *Ocimum basilicum* L. under control condition and enhanced UV-B radiation exposure.

and surface anatomical adaptation like increase the leaf trichomes, thicker the leaves and reflectance of leaf surface by hairs (Figure:1). The increased trichome frequency which could have been an adaptive feature to UV-B treatment is at variance from the reductions observed by Karabourniotis *et al.,* (1995).Studies performed in *Vaccinium myrtillus* report that leaf thickness increases under enhanced UV-B radiation (Phoenix *et al.,* 2001).

Moreover, under enhanced long term UV-B exposure, a decrease in adaxial trichome density in *Vaccinium uliginosum* has been observed (Semerdjieva *et al.,* 2003). However, these effects on leaf morphology are not generalized in other *Vaccinium* species (Semerdjieva *et al.,* 2003).The *Ocimum* plant synthesised volatile oil gland to synthesis volatiles. The UV-B treated plant increase the number of the volatile oil glands on the surface of the leaf (Figure: 2) Previous studies reported that UV-B not only increased the total phenol content but also changed the composition of these oils (Johnson et al.1999, Kumari and Agrawal, 2011, Ciurli *et al.,* 2017). In contrast, Ioannidis *et al.,* (2002) stated that neither the quality nor the quantity of the volatiles was affected by UV-B. The present findings represent a compromise between these two reports, that is the total content of volatiles was significantly increased by UV-B but there was no effect on composition.

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