

Introduction:

Intumescence and edema development are physiological disorders that are often referred to interchangeably and primarily affect plant leaves. When damage is severe, economic loss can result from reduced aesthetic value or yield losses related to photosynthetic area.

The cause of these disorders has not been conclusively determined. Our research focused on the effect of ultraviolet light in the wavelength range of 280-320 nm (UVB).

Our objective was to determine if UVB light affects the incidence and severity of these disorders on two plant species, ivy geranium and tomato.

Materials and Methods:

UVB Light:

- Two treatments, UVB blocked and UVB supplemented (Figs. 1 and 2)
- UVB-emitting fluorescent light bulbs mounted over both treatments with blocked treatment covered with UV-absorbing polyethylene (Fig. 1)

Plant Materials:

- Tomato cultivars (*Solanum lycopersicum* L.): 'Maxifort' (var. *hirsutum*) and 'Trust' (var. *esculentum*)
- Ivy geranium cultivars (*Pelargonium peltatum* L'Herr ex. Ait.): 'Amethyst', 'Lambada' and 'Sybil Holmes'



Fig. 1. UVB-apparatus with UVB-supplemented treatment shown on the left and UVB-blocked treatment shown on right. UVB-emitting fluorescent light bulbs are suspended above both treatments with UV-absorbing polyethylene tent over the UV-blocked treatment. Plastic light diffusers were used to prevent sunburn of plant tissues while still allowing UV-transmission.

Microscopy:

- Dissection microscopy: Fresh samples placed under dissection microscope with 3X magnification
- Scanning electron microscopy: Fresh samples fixed using rapid freezing; high vacuum used with backscatter detector, 90X (tomato) and 40X (geranium) magnification

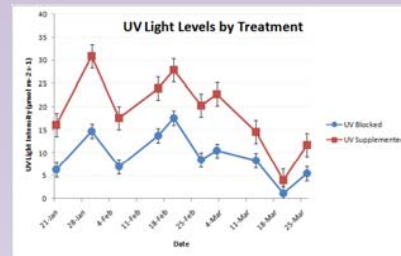


Fig. 2. Graph of UV intensity measured with a Field Scout 3414 Ultraviolet Light Meter (Spectrum Technologies Inc., Plainfield, IL) taken weekly from 6 weeks prior to the start through the termination of the Spring 2009 UV light experiment with tomato. The wavelengths measured with this meter ranged from 250-400 nm, a broad spectrum of UV wavelengths.

Table 1. Percent leaves and leaflets affected on the tomato cultivar 'Maxifort' between two UVB treatments, blocked and supplemented. Pair-wise comparisons ($\alpha=0.05$) were significant.

UVB Treatment	% Leaves Affected	% Leaflets Affected
Blocked	30.3% a	11.7% a
Supplemented	6.0% b	1.1% b

Summary of Results:

UVB Light

- Significantly affected intumescence development in susceptible tomato (var. *hirsutum* 'Maxifort') but not the resistant var. *esculentum* 'Trust' (Table 1)
- No effect on ivy geranium cultivars

Are edema and intumescence development different?

- Yes – the differences in lesion development at the cellular level (Fig. 3) and the strong relationship between tomato intumescences and UVB light suggest that they are two different disorders.

Conclusions:

- Edema and intumescence development are different disorders.
- Intumescence development of susceptible plant species/varieties may be diminished with UVB light supplementation, but edema is not affected.

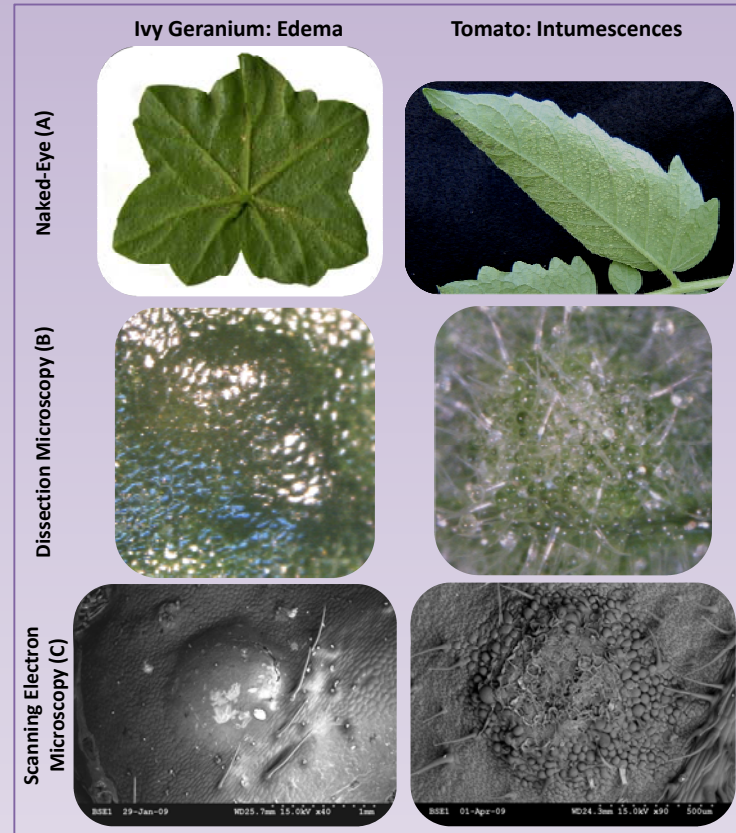


Fig. 3. Intumescences on ivy geranium 'Amethyst 96' (left column) and tomato 'Maxifort' (right column) on abaxial leaf surfaces as seen with the naked eye (A), dissection microscopy (B) and scanning electron microscopy (C).

We would like to thank:

Kent Hampton for his SEM expertise, Holly Davis for her help in taking DM photographs and the Gloeckner Foundation for funding our research.

