BMC Plant Biology

Meeting abstract

UV-A induced fluorescence images in sun and shade leaves

Fatbardha Babani*[1], Gabriele Langsdorf[2], Martin Knapp[2], Claus Buschmann[2] and Hartmut K Lichtenthaler[2]

Address: [1]Department of Biophysics, Biological Research Institute, Academy of Sciences, Tirana, Albania and [2]Botanical Institute II, University of Karlsruhe, Kaiserstr.12, D-76128 Karlsruhe, Germany

Email: Fatbardha Babani* - fbabani@yahoo.com

* Corresponding author

from Cell Biology of Nitric Oxide and Cell Death in Plants
Yalta, Ukraine, 8–11 September 2004

Published: 31 May 2005

BMC Plant Biology 2005, **5**(Suppl 1):S3 doi:10.1186/1471-2229-5-S1-S3

Background

At their natural environment plants are exposed to high fluxes of photosynthetically active and UV radiation. The increased synthesis of UV-absorbing compounds, such as flavonoids and other polyphenols, are accepted as a plant response to increased UV radiation. The increase of leaf flavonoid content can be a protection against the harmful effect of UV-B radiation as they function as antioxidant and UV filters in plants. Differences between sun and shade leaves (adapted to high light and low light respectively) of some tree species are analysed, taking in consideration differences on the UV-A absorption via fluorescence imaging of leaves.

Materials and methods

Leaves of beech (*Fagus sylvatica* L.), maple (*Platanus hybrida* L.) and poplar (*Populus nigra* L.) were analysed. The Karlsruhe flash-lamp fluorescence imaging system (FLFIS) was used to measure images at the fluorescence bands blue, green, red and far-red. The decline of chlorophyll fluorescence from Fp to the steady-state Fs was imaged too [1].

Results

Shade leaves exhibited a much higher chlorophyll fluorescence yield than sun leaves. Also differences in the distribution of the fluorescence over the whole leaf were detected which are due to the lower chlorophyll content of shade leaves and a lower reabsorption of the emitted F690 band. Shade leaves are characterized by lower values of the fluorescence ratios blue/red (F440/F690) and blue/far-red (F440/F740) than sun leaves. Both ratios are early indicators of stress to the photosynthetic apparatus. The fluorescence ratio red/far-red expressed lower values in sun leaves and is an indicator of their higher chlorophyll content (curvilinear inverse correlation). The R_{Fd}-images (R_{Fd} = (Fp-Fs)/Fs) as indicators of photosynthetic activity allow to evaluate differences in photosynthetic quantum conversion.

Conclusion

The observed differences in the fluorescence images and chlorophyll fluorescence images allow to characterize the different properties of sun and shade leaves related to their adaptation to high light and high UV-radiation or low light and low UV-radiation.

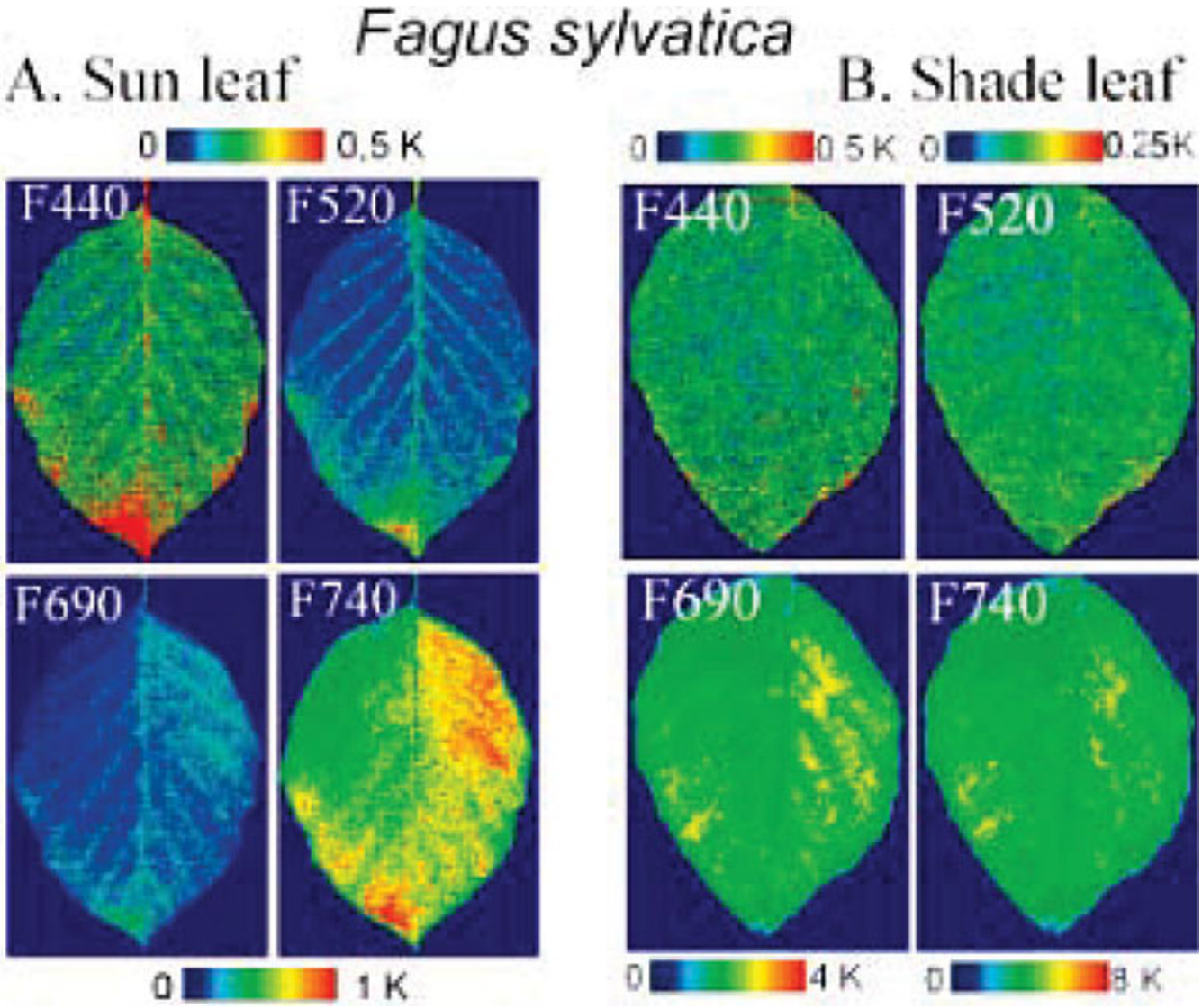

Figure 1
UV-flash lamp induced fluorescence images of the blue (F440), green (F520), the red (F690) and far-red fluorescence (F740) of the sun (**A**) and shade (**B**) beech leaf.

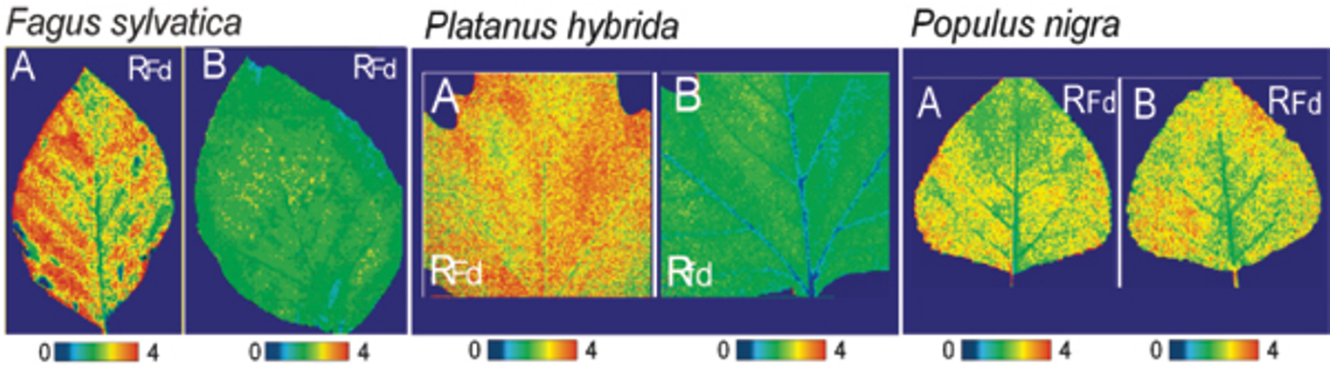

Figure 2
Images of the red chlorophyll fluorescence decrease ratio of a sun (A) and shade (B) leaf of beech, maple and poplar.

References

1. Lichtenthaler HK, Babani F: **Detection of photosynthetic activity and water stress by imaging the red chlorophyll fluorescence.** *Plant Physiol Biochem* 2000, **38:**889-895.