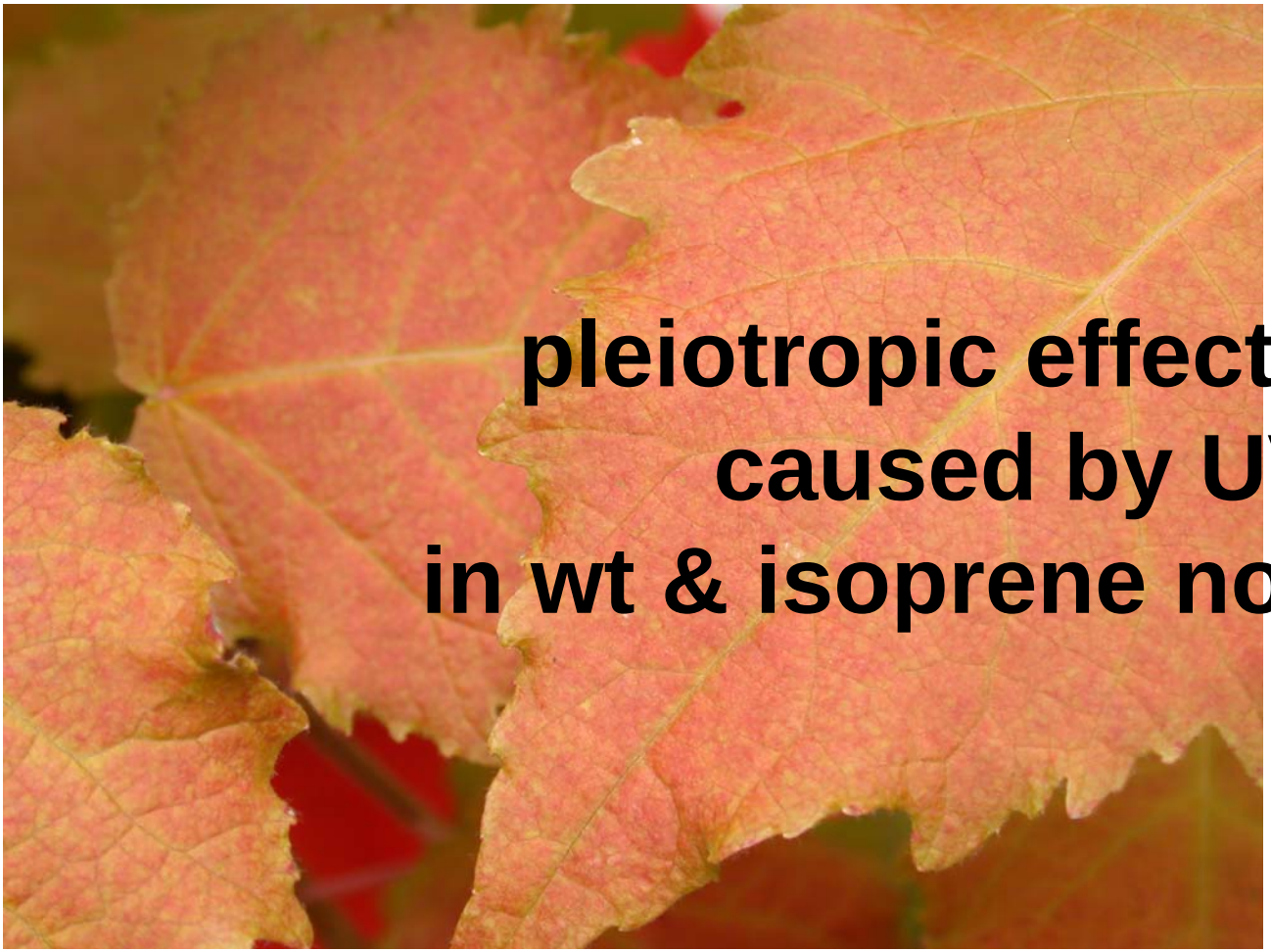

pleiotropic effects in grey poplar caused by UV radiation in wt & isoprene non-emitting plants

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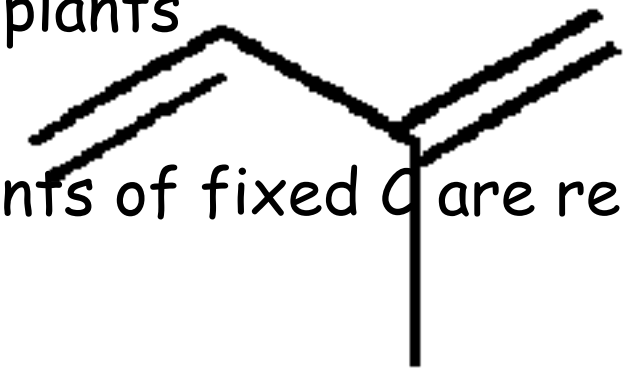
pleiotropic effects in grey poplar caused by UV radiation in wt & isoprene non-emitting plants

- BVOCS contribute to ozone-formation & global warming
- BVOS are carbon bases molecules
- chances in carbon-fluxes might alter BVOC emissions

→ UV as a trigger to alter "C"-sequestration within the cell

- in our work-group we study isoprene-emission

- mainly on grey poplar (*Populus* x *canescens*)
  in wt & transgenic plants



- considerable amounts of fixed C are released from the pl
  as isoprene

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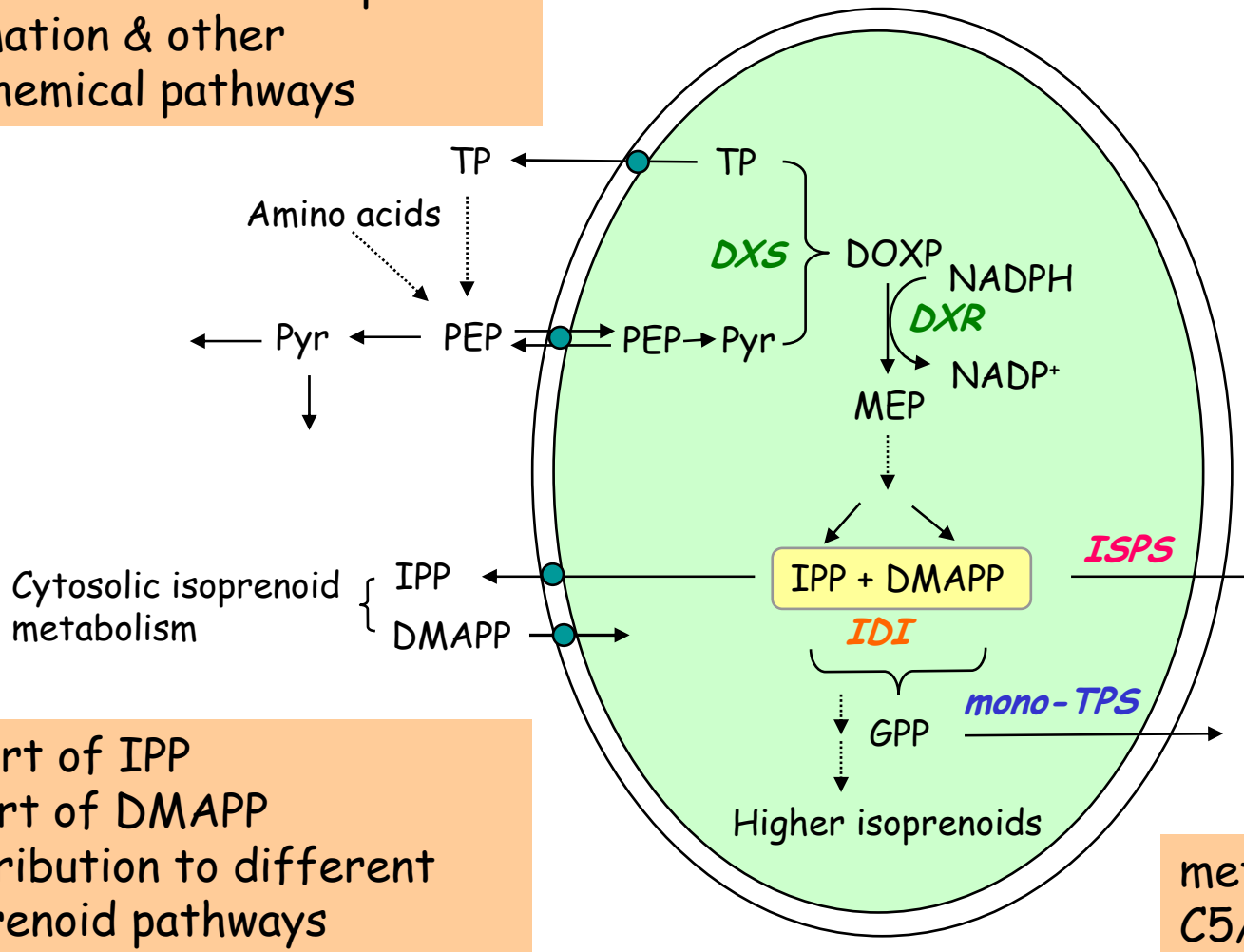
quantification of variable „C" pools

crosstalk between isoprene formation & other biochemical pathways

regulation of MEP pathway (feedback control; post-translational modifications)

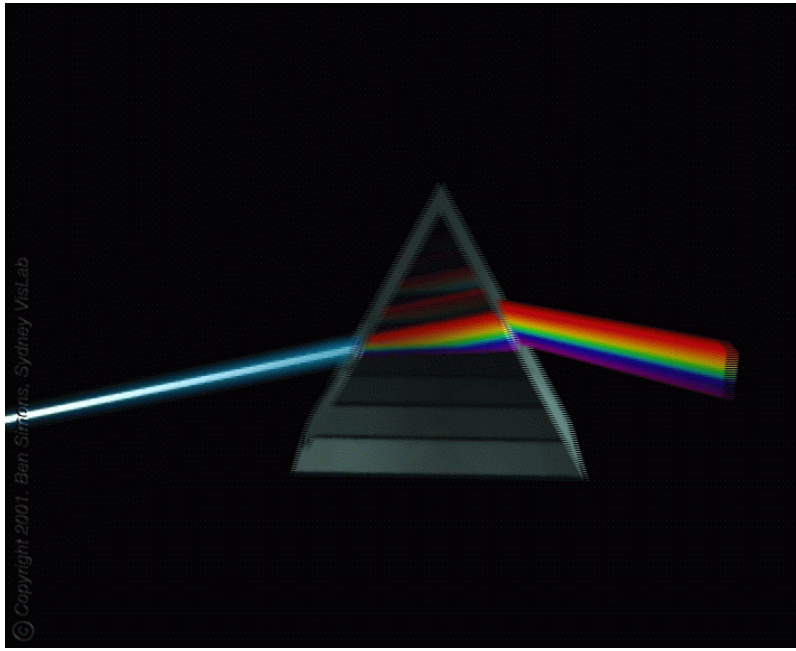


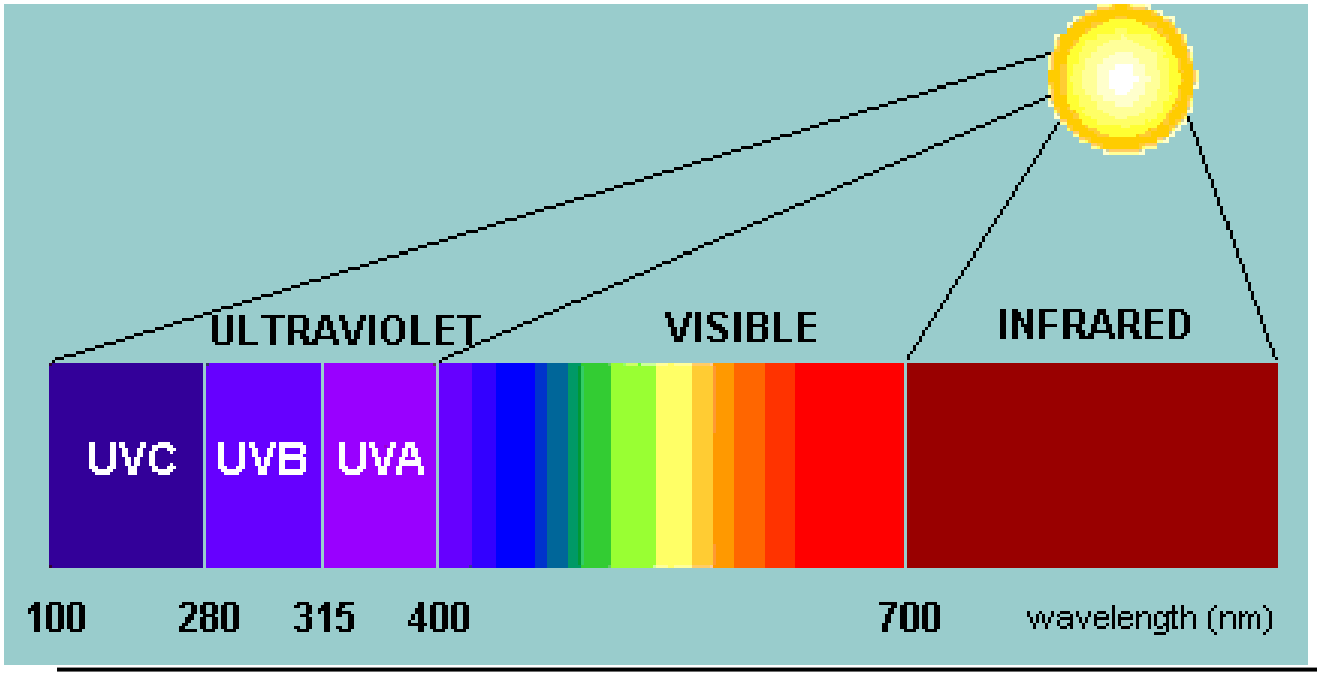
export of IPP
import of DMAPP
contribution to different isoprenoid pathways

metabolic competition: C5/C10 versus C40 isoprenoids

what is UV radiation anyway?

- high-frequent light
- low wavelength (280-380nm)
- not visible to human eyes





UV effects - direct:

- oxidative damaging of macro-molecules such as DNA, aromatic amino-acids & membrane-lipids
- generation of reactive oxygen species (ROS)

UV effects - indirect:

- induction of synthesis of protective compounds such as phenolic compounds & carotinoids…
- changes in gene-expression at different levels:
  - transcription
  - translation
  - post-translational modification
- induction of anti-oxidative enzymes

e.g. Brown *et. al.*, 2005; Jordan, 2002

what is the idea of the experiment, then?

- UV has in impact on the cells metabolism
- so it might change the use of carbon & its fluxes

→ therefore UV possibly also affects isoprenoid metabolism & isoprene emission?

→ the data should become integrated in a cellular model of BVOC emission

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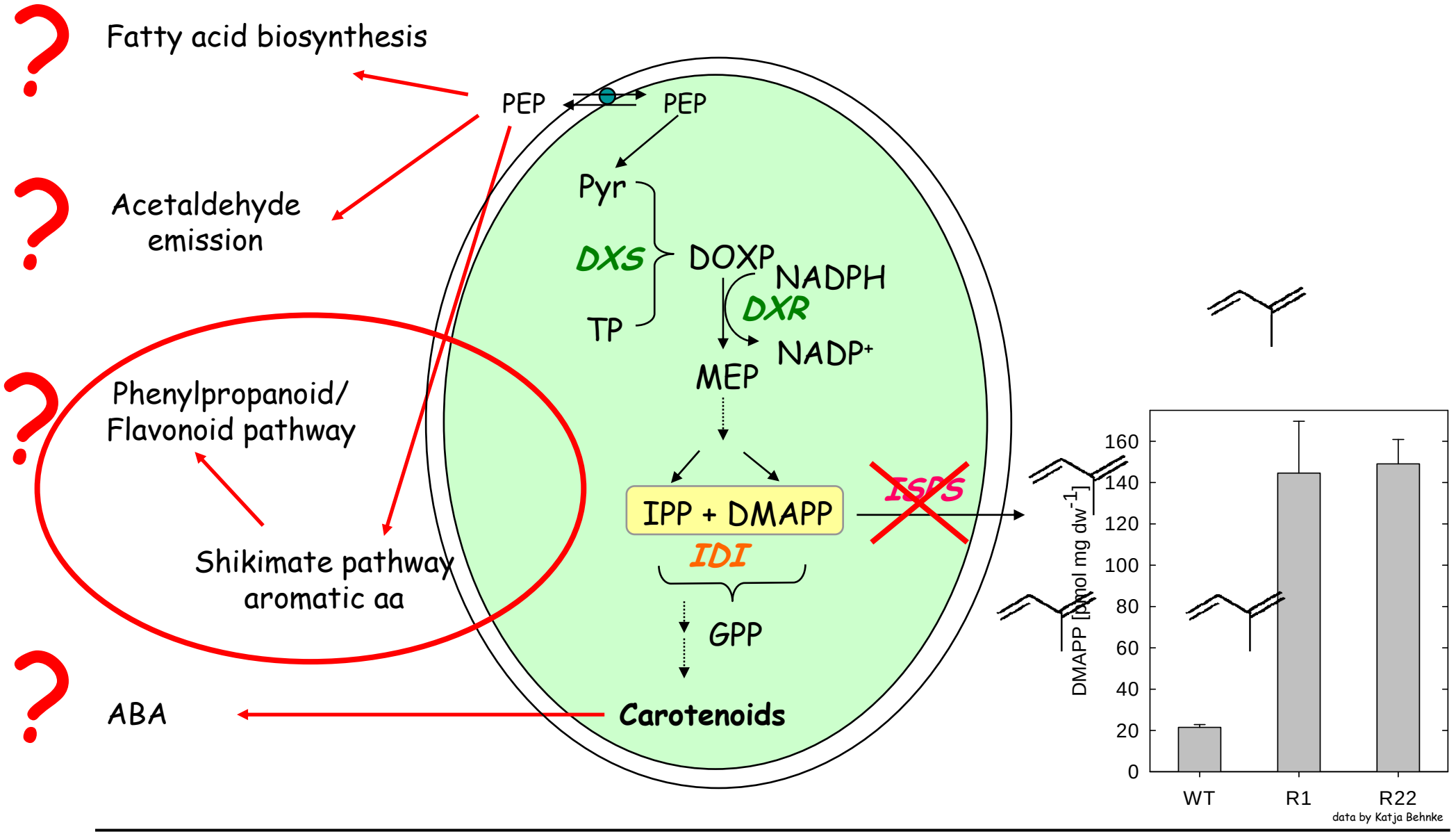
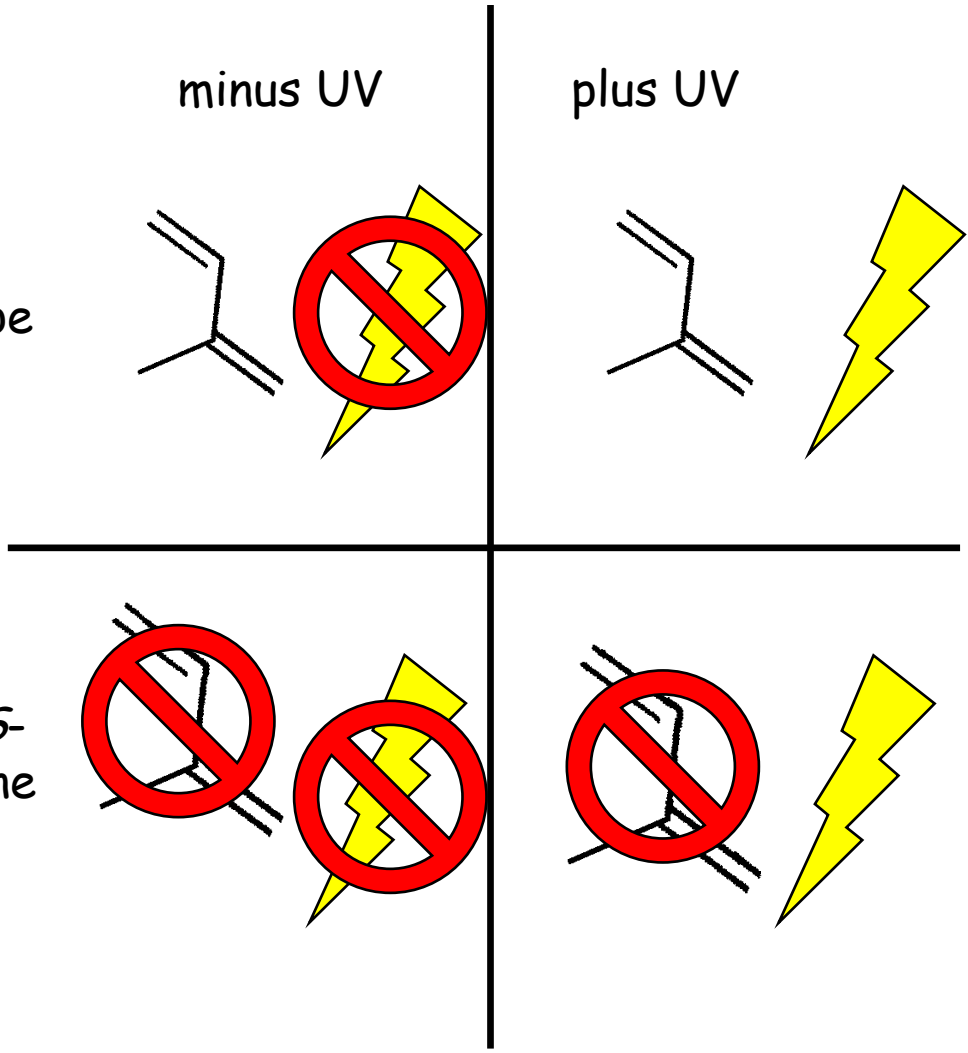


SO:

- exposure of poplar plants to UV radiation in comparison to un-radiated plants

- also we compare wt vs. transgenic lines



→ 4 treatments

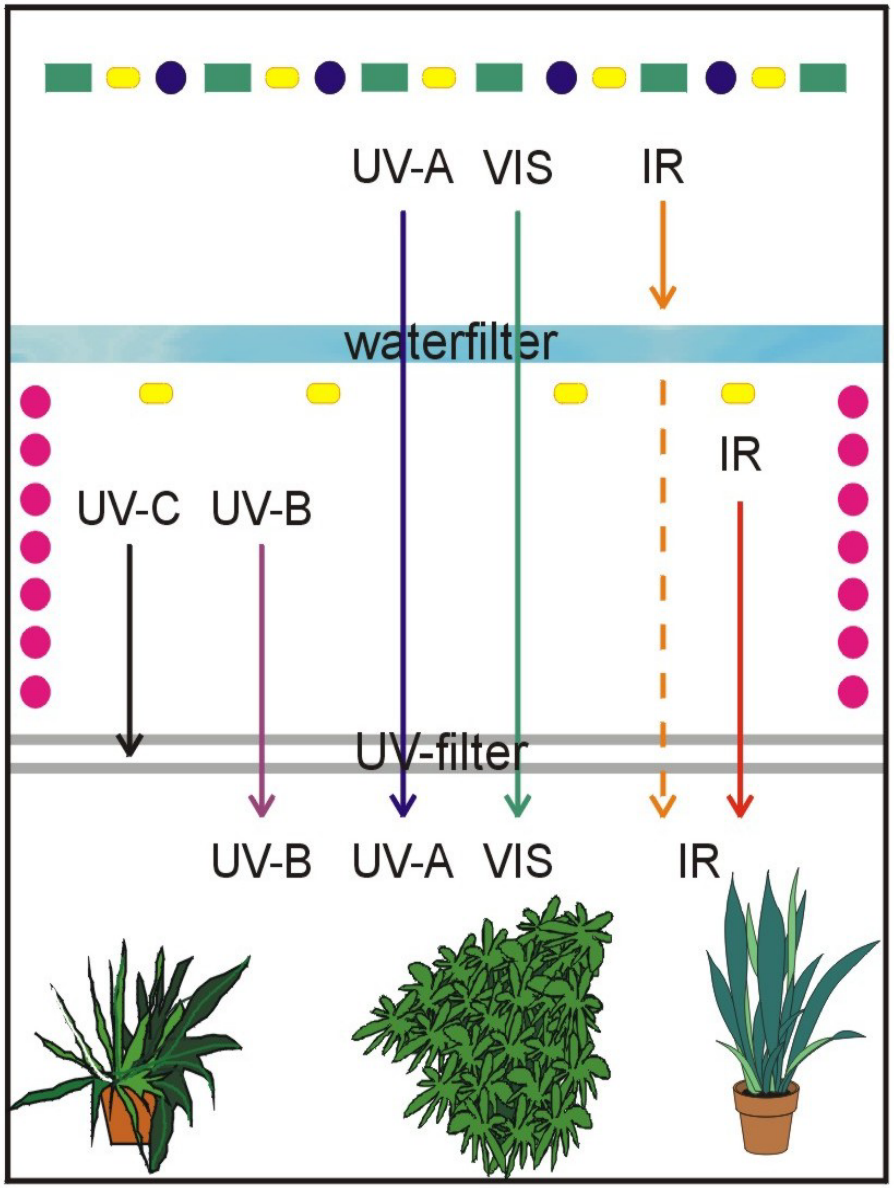
how did we set up the x-periment:

- sun-simulators at the Helmholtz Centre, Munich
- these allow a good approximation to the solar spectrum
- under controlled conditions
- 2 repeats

on-line monitoring:

- PTR-MS (Ionicon, Austria)
- GFS-3000 (Walz, Germany)
- Mini-PAM (Walz, Germany)

schematic outline of the sun simulators

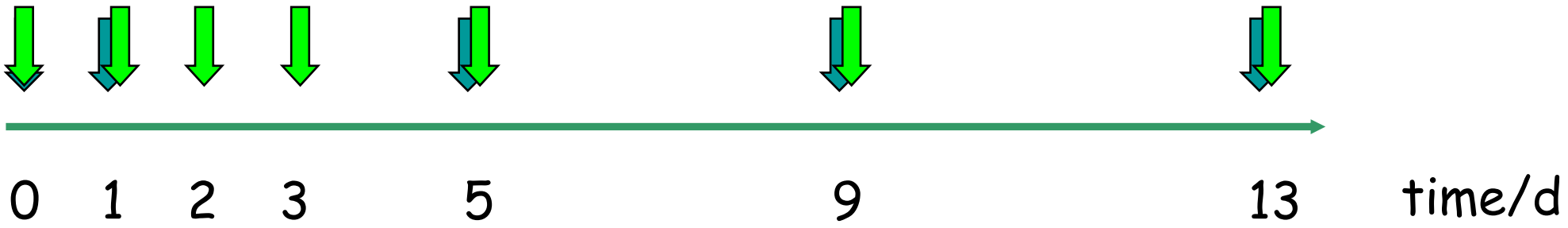


picture by Dr. Andreas Albert

Metal halide lamps
Quartz halogene lamps
Blue fluorescent tubes
UV fluorescent tubes

timing:

- in total 2 weeks of monitoring
- *on-line* measurements at days 0,1,5,9,13
- harvest of leaves at days 0,1,2,3,5,9,13



in vitro measurements include:

- analysis of:
  - PS-Pigments via HPLC
  - Metabolomics via ICR-FT/MS
  - Phenolic compounds via HPLC-MS
  - Gene-expression via RT-PCR

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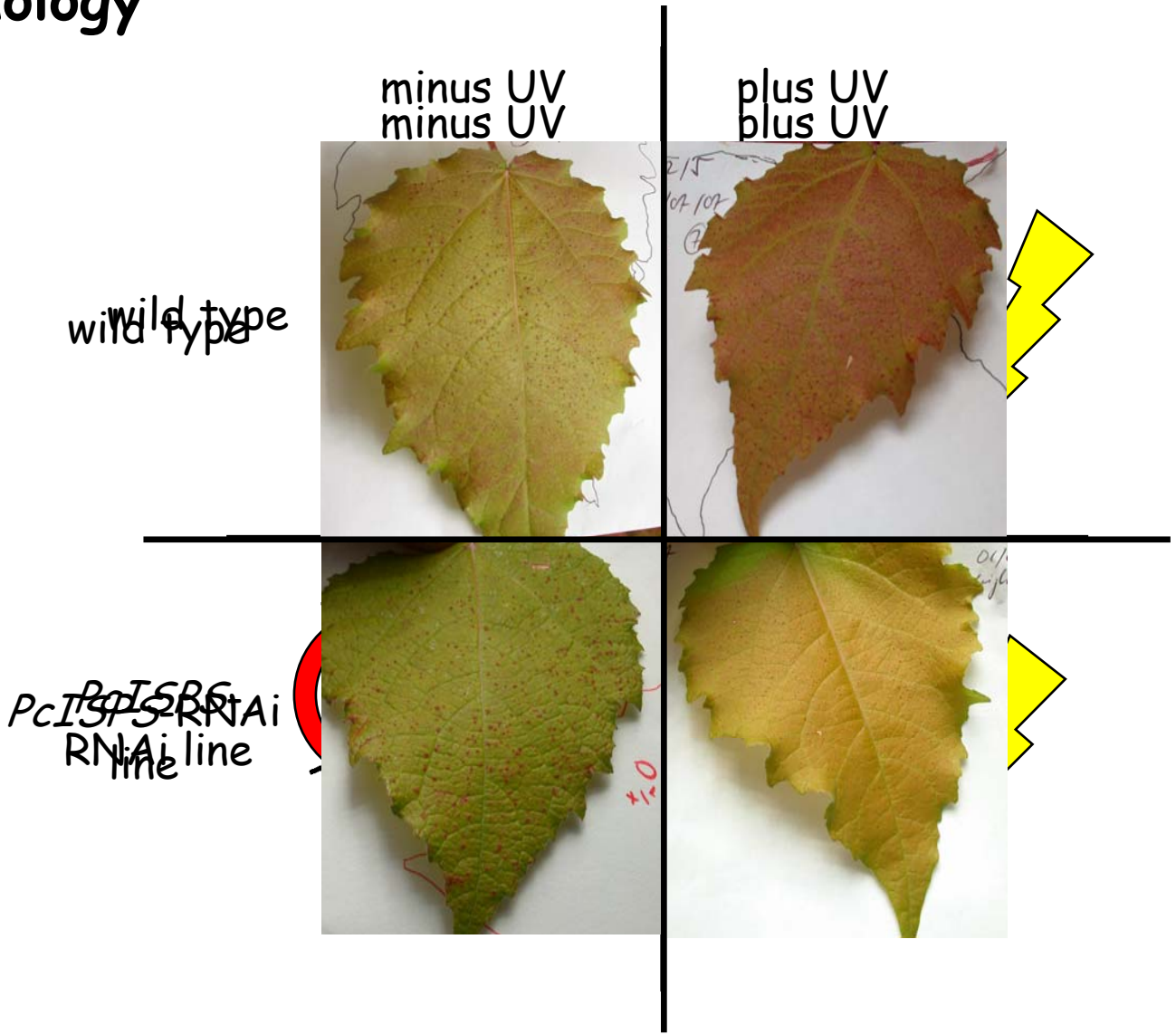
Morphology



No Differences

- photosynthetic parameters

- carotinoid-content

- α-tocopherol-level

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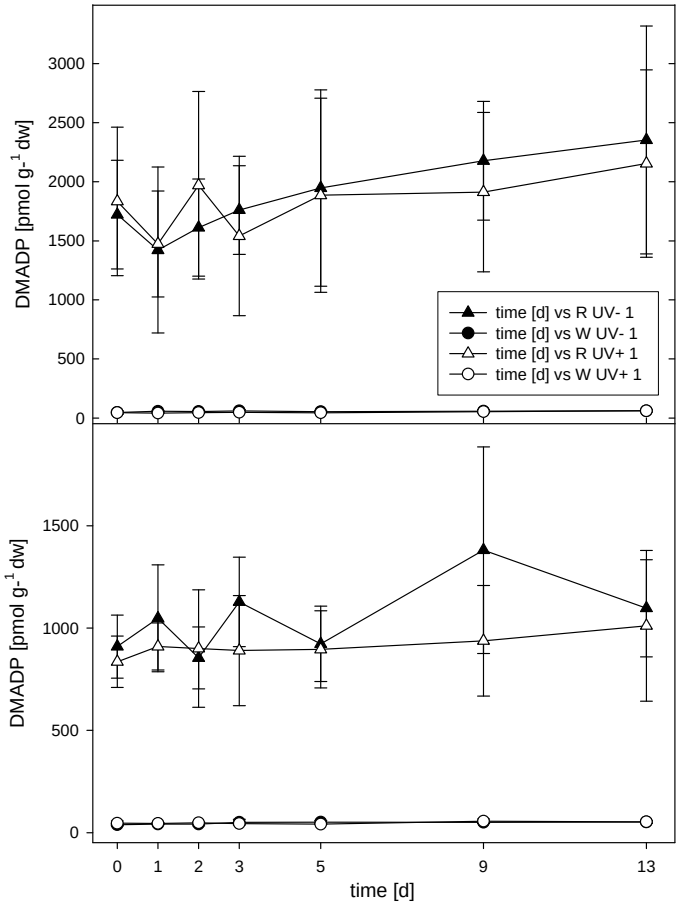
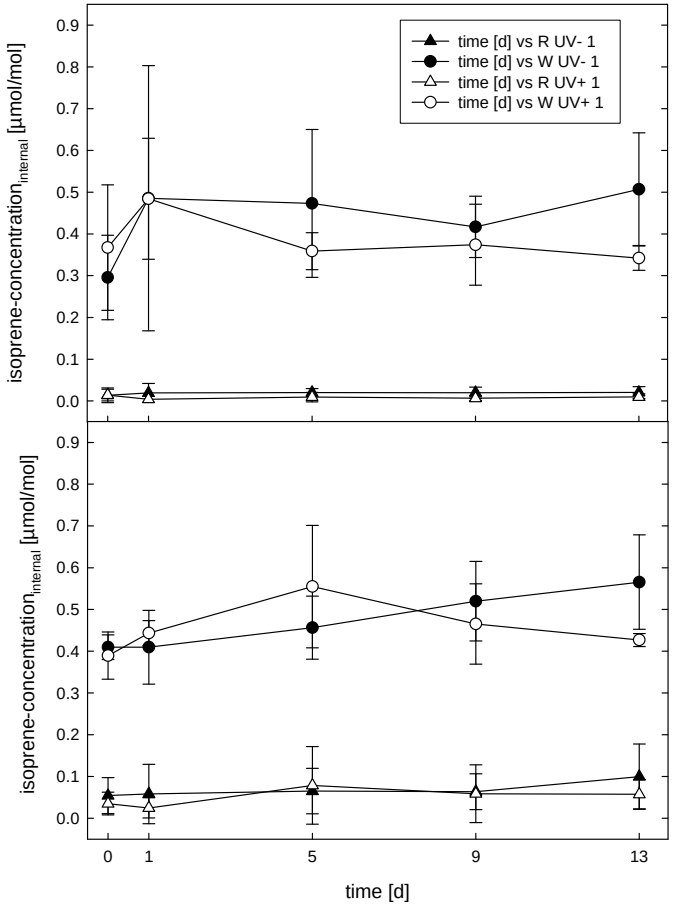
DMAPP & Isoprene

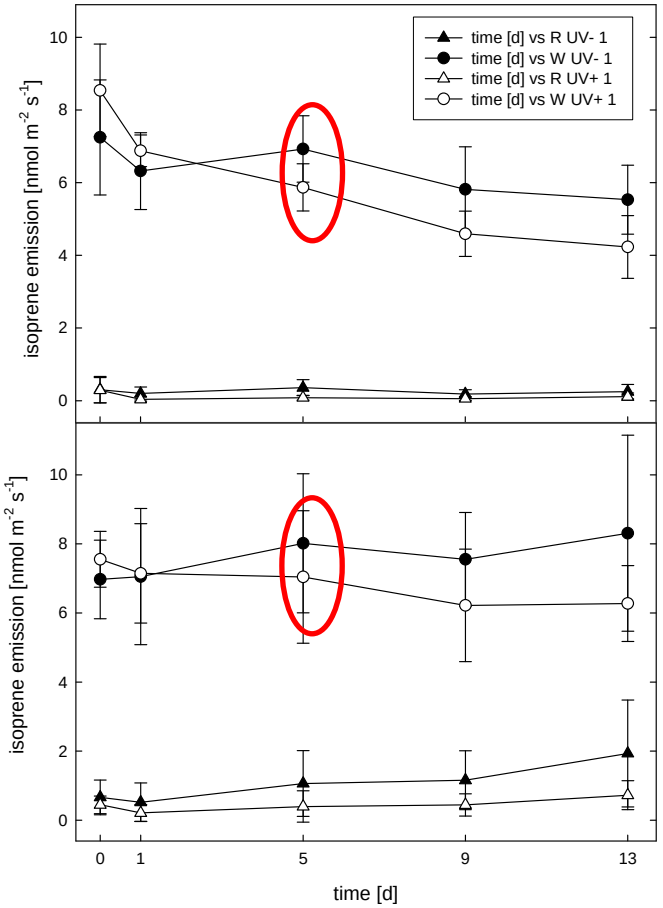
DMADP



Isoprene-Concentration$_{internal}$



Isoprene Emission

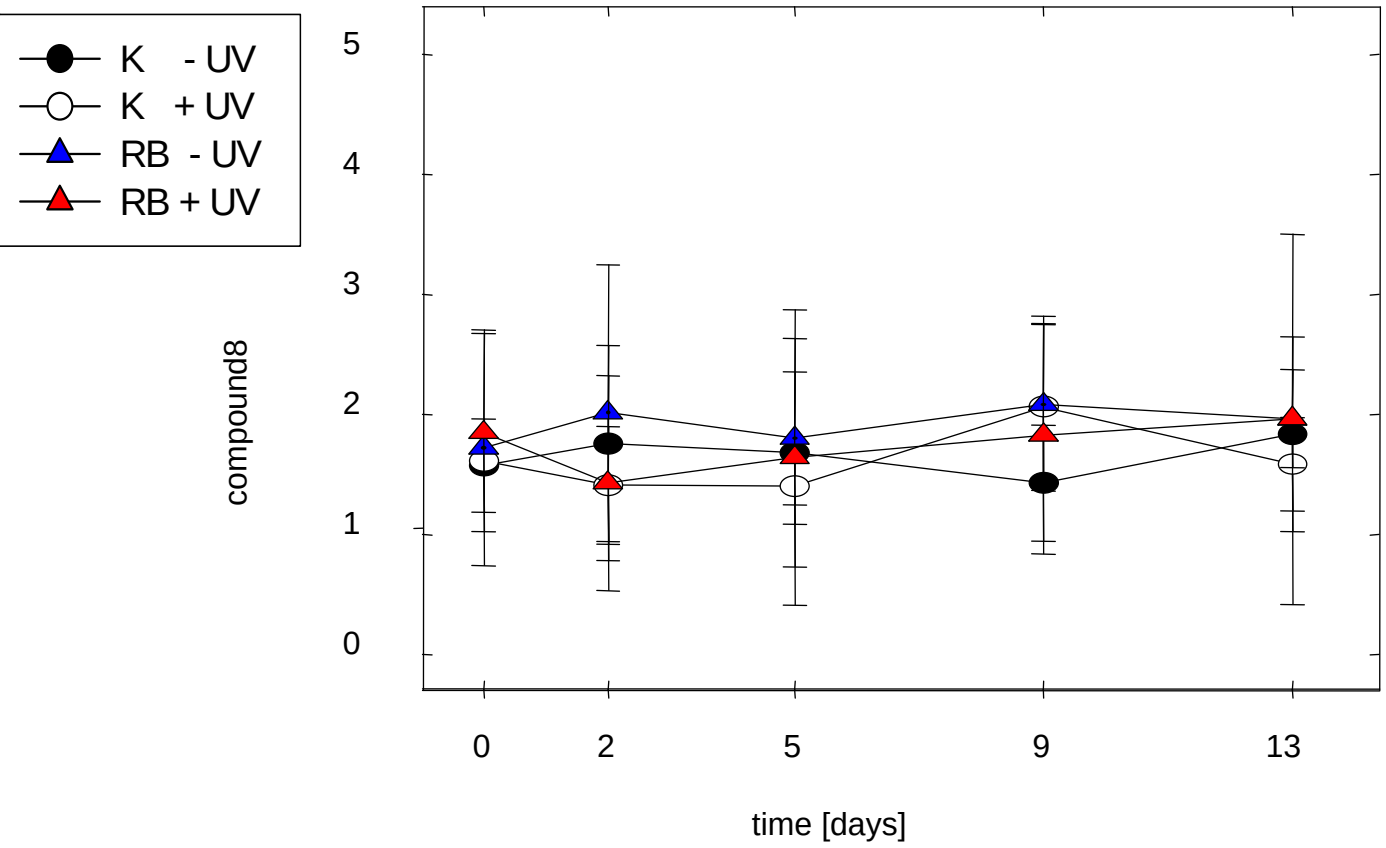


introduction idea set-up **results** conclusions out-look

Anthocyans &
other Phenolic compounds

…more than 20 different compounds were found & quantified…

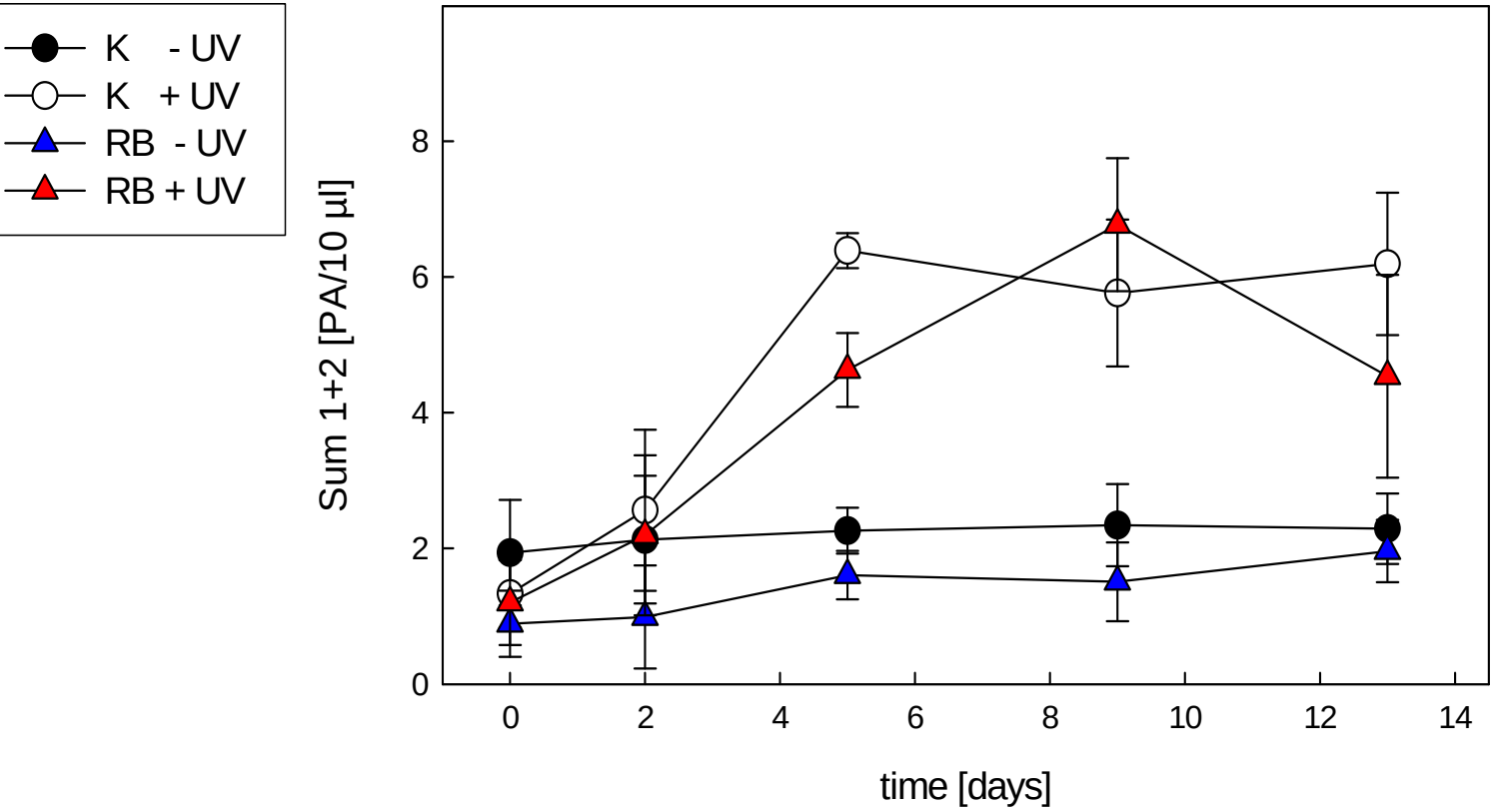
Anthocyans & other Phenolic compounds



phenolic compound 8 :

- no line-effect
- no treatment-effect
- no time-effect

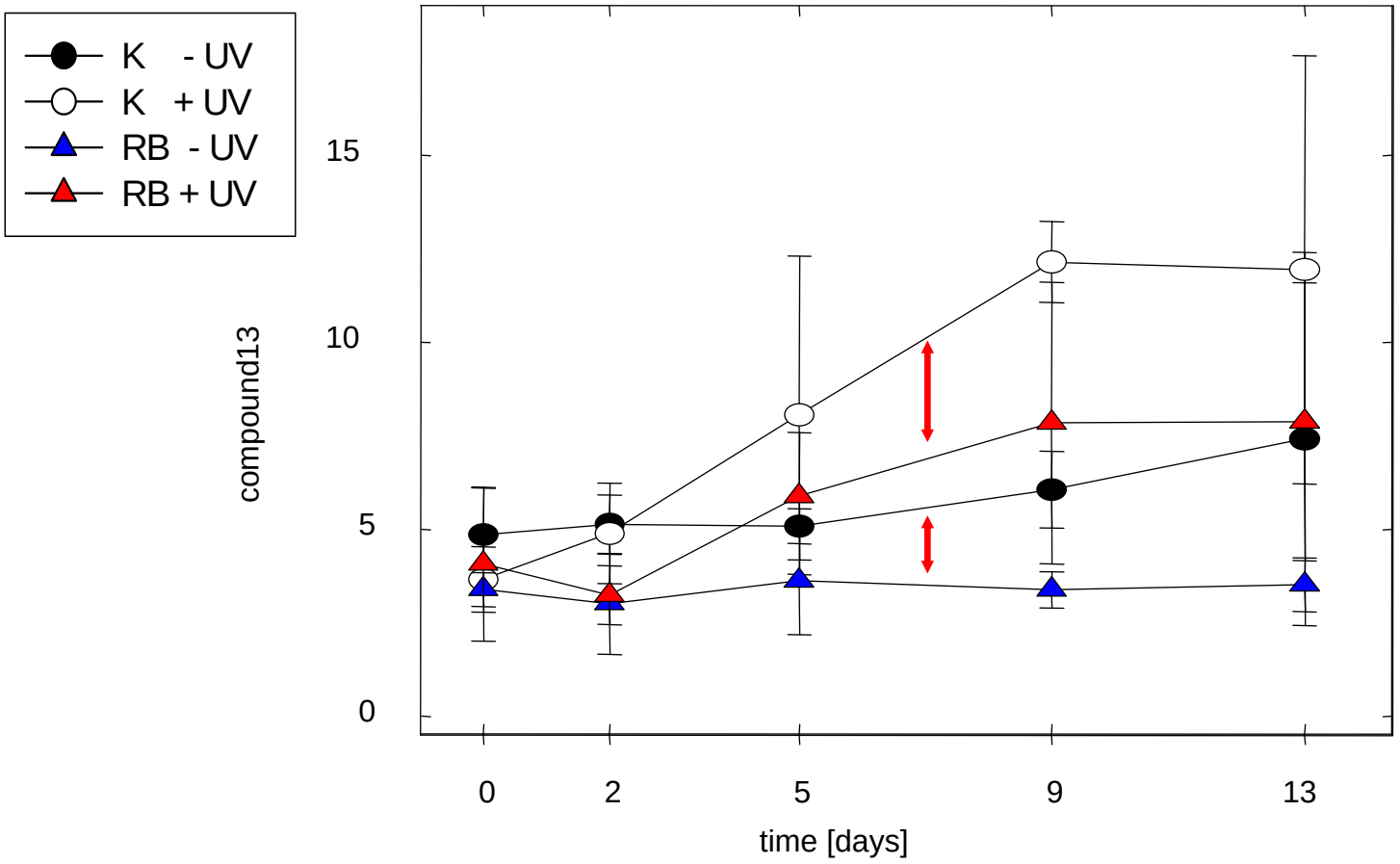
Anthocyans & other Phenolic compounds



Anthocyans:

- treatment-effect
- time-effect

Anthocyans & other Phenolic compounds

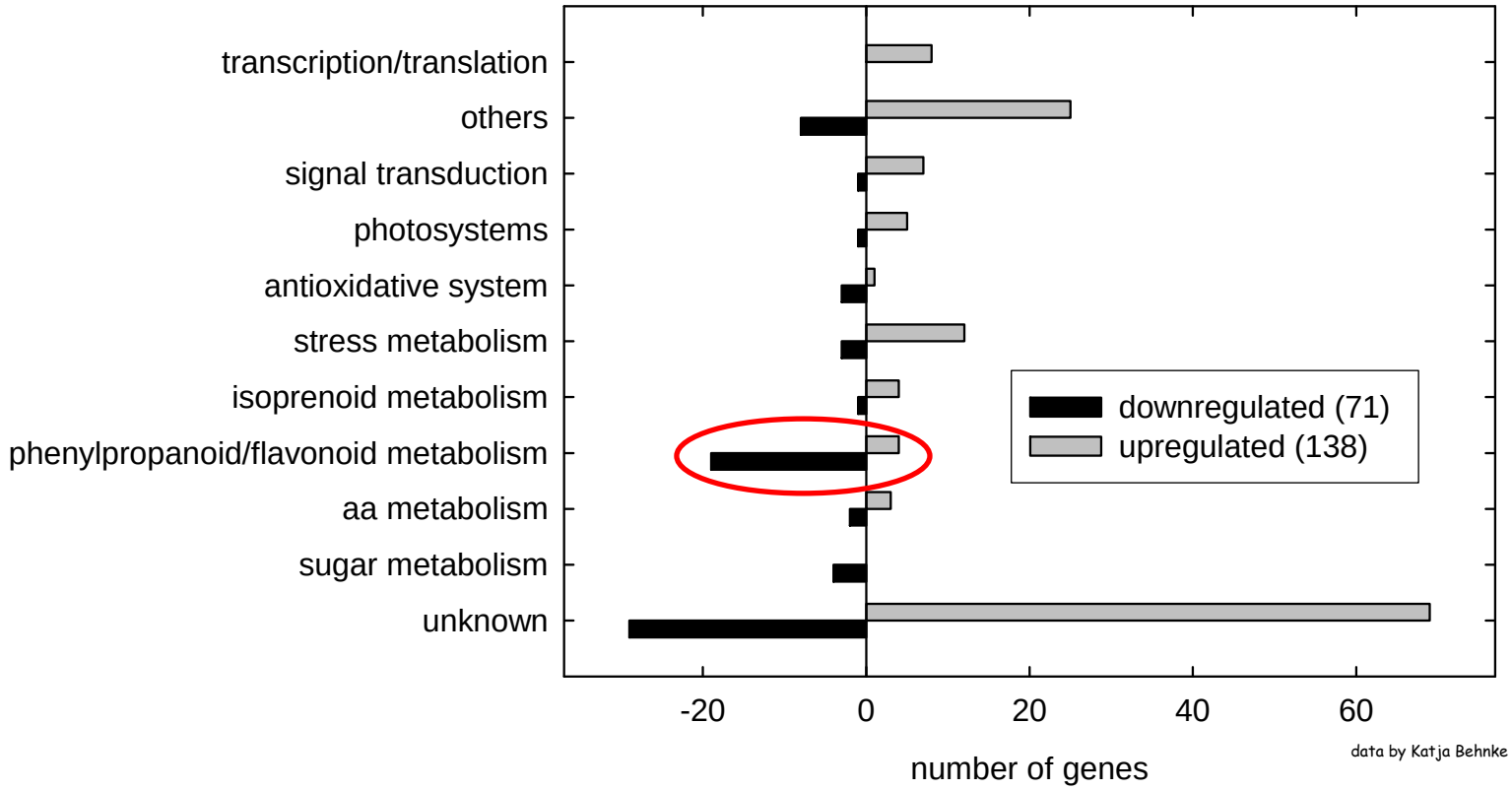


campherol-derivate:

- line-effect
- treatment-effect
- time-effect

R-lines show less flavonoids!

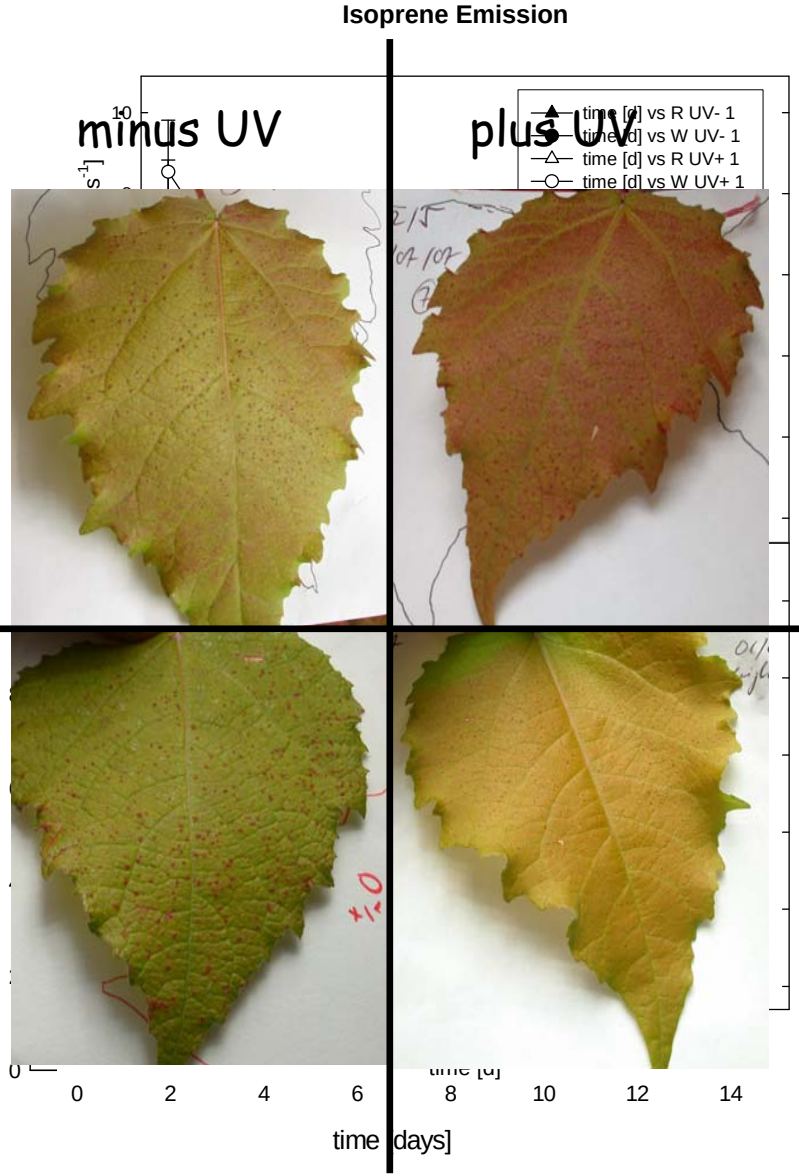
up and down regulation of pathways



review:

- by eye: clear effect of treatments
  wild type
- effects in anthocyans & flavonoids
- isoprene metabolism emission shows clear trends

PcISPS-RNAi line



interpretation:

- isoprene emission is probably linked to UV-response in poplar
- UV-radiation can be used to alter "C"-fluxes in plant systems
- isoprene is not a compound proteting the plant from UV effects, but rather acting competitive for "C"

interpretation:

- interesting however, is the observed decrease in flavonoid content in the ISPS-repressed plants

this study:

- promising to analyse flavonoid gene expression
  - i.e. find target genes responsible for expression-pattern
  - quantify there expression levels

- structure analysis of phenolic compounds

- METABOLMIC analysis should show compound composition & distribution in more detail

future prospects:

- METABOLOMICS provide a powerful tool for easy data-access
- transgenic lines will help to better understand cellular processes
- cooperation with modelers will help to better:

  - predict
  - understand

future scenarios

many thanks to:

co-operating scientists from the Helmholtz Centre:

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- Dr. Andreas Albert

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- Peter Kary
- Werner Rupprecht

my supervisor:

Prof. Dr. Joerg-Peter Schnitzler

…and…of course:

you, for your attention…