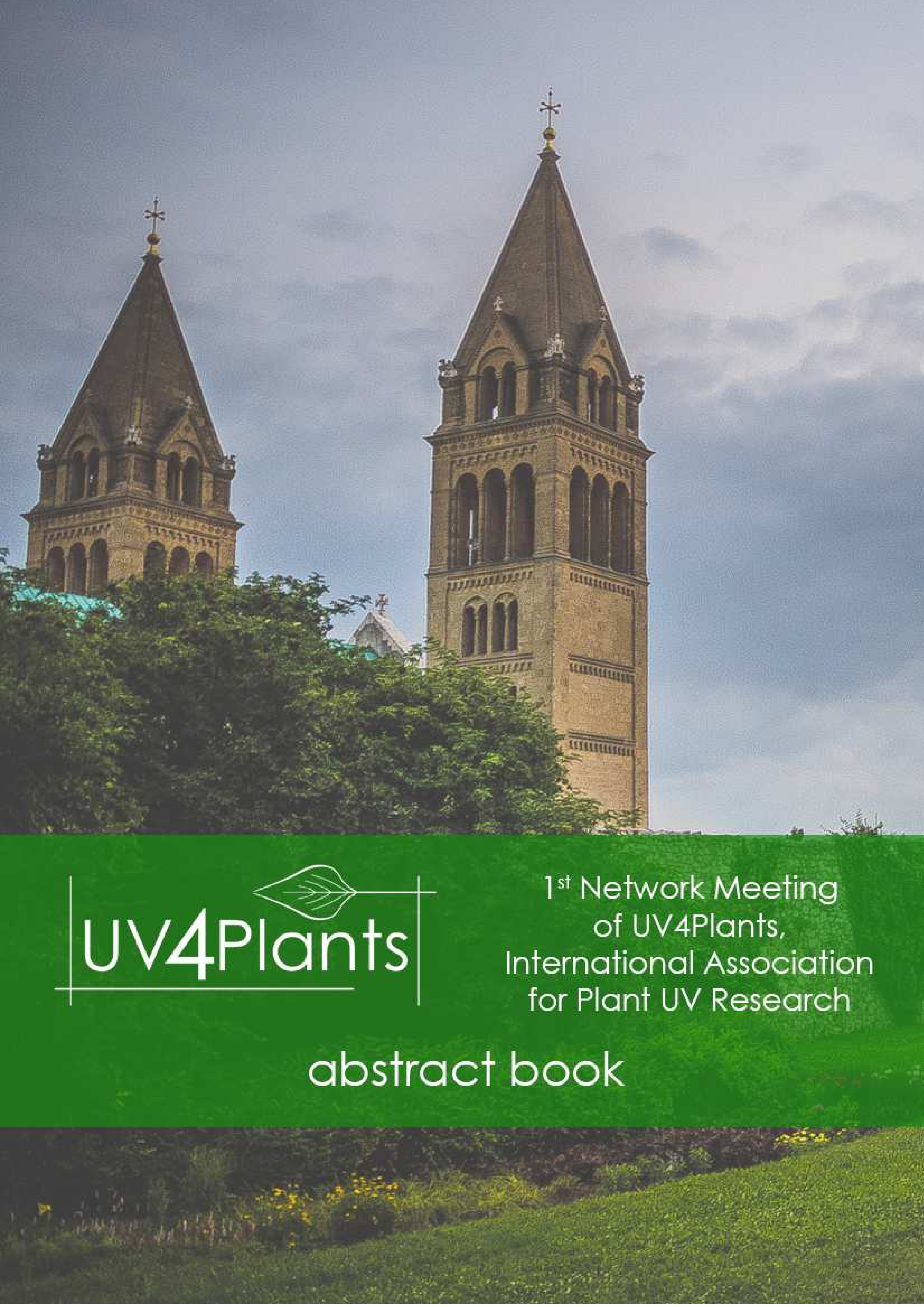

UV4Plants

1st Network Meeting of UV4Plants, International Association for Plant UV Research

abstract book

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abstract book

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About UV4Plants

To build on the achievements of COST-Action UV4Growth, a core-group of former members has in 2014 formed a new international association for plant UV-research, named UV4Plants.

The key aims of UV4Plants are:

- To promote and foster a culture of research-excellence and good practice in Plant UV Research through the organisation conferences, public engagement and education.
- To provide channels for members to inform the Plant UV Research community about relevant activities or events of common interest.
- To increase the visibility of Plant UV Research by facilitating the transfer of knowledge from academia to stakeholders and the general public.
- To initiate and foster stakeholder contacts as part of an agenda of product development.
- To liaise with scientific funding bodies to influence their research agenda.
- To develop with its members the benefits of membership and the relevance of the Association.

In practice, this will mean organising a mixture of UV-focussed plant conferences, training schools and lobbying for funding. It is anticipated that a General Meeting of the Association will be held every other year, in conjunction with a UV-related and/or plant conference.

UV4Plants warmly invites plant UV researchers to join this initiative by becoming a member.

The UV4Plants managing committee 2014 - 2016:

Prof Marcel Jansen (President)

Prof Åke Strid (Vice-President)

Mr Gyula Czégény (Secretary)

Dr Matt Robson (Treasurer)

Dr Pedro J. Aphalo (Communications Officer)

Dr Susanne Neugart (member)

Dr Laura Llorens Guasch (member)

Welcome to Pécs

Dear Delegates,

UV4Plants and the University of Pécs are delighted to welcome you to Pécs. This first network meeting of the International Association for Plant UV Research (UV4Plants) represents both continuity and a new beginning. The Association was founded in 2014 but many members have already long standing successful research collaborations. This conference, and a subsequent Training School aimed at early stage researchers, will be an exciting opportunity to discuss research with colleagues and to expand our collaborative networks.

One of the key strengths of the field of plant UV-research has been the integration, and indeed cross-fertilisation, between different research approaches. We are pleased to present a programme that shows the wide scope and relevance of plant UV-research with talks covering basic as well as applied research, aquatic as well as terrestrial ecosystems, and molecular as well as physiological and ecological approaches.

We are grateful to our main sponsors, UV4Plants and the University of Pécs, for their support.

Enjoy the meeting, engage in the exciting programme of talks and posters, make new friends, and establish new collaborations!

Prof Éva Hideg
Chair
Organising committee

Prof Marcel Jansen
President
UV4Plants

Detailed program

30 May

University of Pécs – Szentágothai Research Centre

9.00 - 9.15	opening
chair:	**Marcel Jansen**
9.15 - 9.45	**Gareth Jenkins** | University of Glasgow Molecular basis of plant responses to UV-B
9.50 - 10.10	**András Viczián** | BRC Szeged Tissue-specific aspects of different photoreceptor controlled signalling pathways in *Arabidopsis thaliana*
10.15 - 10.30	**Jakub Nezval** | University of Ostrava The role of blue light and cryptochromes in the regulation of phenolic compound synthesis during the acclimation of *Arabidopsis thaliana* from low to high irradiance.
10.35 - 10.50	**Matthew Robson** | University of Helsinki The importance of cryptochromes, phototropins and UVR8 photoreceptors in the control of plant responses to spectral quality changes in simulated under-canopy conditions.
10.55 - 11.15	tea/coffee break
chair:	**Marie-Theres Hauser**
11.15 - 11.30	**Jorunn Elisabeth Olsen** | Norwegian University of Life Sciences UV-B signaling related to biosynthesis of phenolic compounds in pea
11.35 – 11.45	**Minjie Qian** | Örebro University UV4BASIL: morphology, metabolites, and gene expression
11.50 – 12.00	**Lucas Vanhaelewyn** | Ghent University Phototropin mediated ultraviolet-B phototropism in etiolated seedlings

12.05 – 12.30	short poster presentations **Neha Rai** | University of Helsinki **Justyna Łabuz** | Jagiellonian University Krakow **Brigitta Végh** | University of Pécs **Sissel Torre** | Norwegian University of Life Sciences
12.30 – 14.00	lunch break & poster viewing
chair:	**Donat Häder**
14.00 – 14.25	**Javier Martínez-Abaigar** | University of La Rioja Comparing UV research milestones in bryophytes and seed plants
14.30 – 14.45	**Gonzalo Soriano** | University of La Rioja Contrasting responses of three aquatic bryophytes from mountain streams to sun and shade conditions
14.50 – 15.10	**Éva Hideg** | University of Pécs The role of antioxidants in acclimation to UV-B
15.15 – 15.30	**Gyula Czégény** | University of Pécs The role of chloroplast hydrogen peroxide neutralization in the acclimation of leaves to supplementary UV
15.35 – 16.00	short poster presentations **María de los Ángeles Del-Castillo-Alonso** | University of La Rioja **Laura Monforte** | University of La Rioja **Kristóf Csepregi** | University of Pécs **Anikó Mátai** | University of Pécs
16.00 – 16.20	tea/coffee break
chair:	**Javier Martínez-Abaigar**
16.20 – 16.35	**Marco Santin** | University of Pisa A biochemical and molecular dissection of fruit anthocyanins in anthocyanin-rich tomato mutant after post-harvest UV-B treatment
16.40 – 16.55	**Susanne Neugart** | Leibniz Institute IGZ Flavonoid glycosides in legumes dependent on the cultivar and UV-B

17.00 – 17.15	**Karel Klem** | Global Change Research Institute How does C:N stoichiometry affect UV- and PAR-induced accumulation of flavonoids in barley genotypes?
17.20 – 17.35	**Otmar Urban** | Global Change Research Institute Elevated CO_2 concentration and UV radiation modulate emissions of biogenic volatile organic compounds from European beech saplings
17.40 – 17.55	**Laura Díaz** | University of Girona Effects of UV radiation and rainfall reduction on carbon and nitrogen levels in a Mediterranean shrub community before and after a controlled fire
18.00 – 18.20	short poster presentations **Annamaria Ranieri** | University of Pisa **Carolina F. Assumpção** | Universidade Federal do Rio Grande do Sul **Marija Vidović** | University of Belgrade
evening	**UV4Plants General Assembly**

Detailed program

31 May

University of Pécs – Szentágothai Research Centre

chair:	**Gareth Jenkins**
9.30 – 10.00	**Donat-P. Häder** | Friedrich-Alexander University Productivity of aquatic ecosystems under the stress of increased solar UV-B and global climate change
10.05 - 10.30	**Marie-Theres Hauser** | University of Natural Resources & Life Sciences, Vienna The role of the UV-B photoreceptor in modulation the physiology and growth of *Arabidopsis thaliana* across a European latitudinal gradient
10.35 - 11.00	**Paul W. Barnes** | Loyola University New Orleans Exploring the mechanisms and functional significance of diurnal changes in UV sunscreen protection in plants
11.05 - 11.25	tea/coffee break
chair:	**Paul Barnes**
11.25 - 11.40	**Alan Jones** | Earthwatch Institute Quantifying the role of UV in decomposition of forest litter using litterbags and a trans-European gradient
11.45 – 12.00	**Titta Kotilainen** | University of Helsinki The spectrum of radiation penetrating deciduous forest canopies
12.05 – 12.55	short poster presentations **Marta Pieristè** | University of Helsinki **Mark Tobler** | Loyola University New Orleans **Frauke Pescheck** | Christian-Albrechts- University of Kiel **Andreas Albert** | Helmholtz Zentrum München **Péter Teszlák** | University of Pécs **Laura Diaz** | University of Girona **Knut A. Solhaug** | Norwegian University of Life Sciences **T. Matthew Robson** | University of Helsinki **Pedro J. Aphalo** | University of Helsinki

12.55 – 14.30	lunch break & poster viewing
chair:	**Monika Schreiner**
14.30 – 14.55	**Marcel Jansen** | University College Cork UV-induced changes in plant morphology
15.00 – 15.25	**Pedro J. Aphalo** | University of Helsinki Ultimate and proximate questions about UV perception by plants
15.30 – 15.45	**Aleksandra Golob** | University of Ljubljana Different levels of UV radiation and selene treatment affected morphological, biochemical and optical properties of wheat *(Triticum aestivum)*
15.50 – 16.10	tea/coffee break
chair:	**Pedro Aphalo**
16.10 – 16.25	**Line Nybakken** | Norwegian University of Life Sciences Phenology, growth and metabolism of *Populus tremula* grown along a natural temperature and UV-B gradient
16.30 – 16.45	**Donald Fraser** | University of Bristol A trick of the light: UV-B treatments for glasshouse-grown herbs
16.50 – 17.05	**Knut A. Solhaug** | Norwegian University of Life Sciences Suppression of powdery mildew by UV-B radiation in greenhouse roses, cucumber and tomato – effects of additional light and determination of UV action spectra
17.10 – 17.25	**Inga Mewis** | Institute for Ecological Chemistry, Plant Analysis and Stored Product Protection, Berlin Ecophysiological consequences of UV-B radiation and ozone on Brassicaceae resistance traits
17.30 – 17.45	**Rocío Escobar-Bravo** | University of Leiden Dose- and time-dependent effects of ultraviolet light on tomato resistance to western flower thrips
17.50 – 18.05	closing
19.30 -	Conference dinner

ABSTRACTS OF ORAL PRESENTATIONS

Molecular basis of plant responses to UV-B

Gareth I. Jenkins

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UV-B wavelengths initiate a range of regulatory responses in plants that modify morphology, metabolism and physiology, and include changes in biochemical composition that promote UV-protection and defence against pests and pathogens. Photomorphogenic responses to UV-B are mediated by the photoreceptor UV RESISTANCE LOCUS8 (UVR8) [1]. UVR8 signaling leads to the regulation of transcription of numerous genes that underpin photomorphogenic responses. In addition, UV-B regulates the expression of many genes independently of UVR8, although the signaling pathways involved are not well defined.

Recent research has enhanced understanding of UVR8 action. UVR8 is a 7-bladed -propeller protein that exists as a homodimer in the absence of UV-B. UV-B photoreception causes rapid dissociation of the dimer into monomers that interact with the CONSTITUTIVELY PHOTOMORPHOGENIC 1 (COP1) protein to initiate signaling and hence gene expression. UVR8 stimulates expression of REPRESSOR OF UV-B PHOTOMORPHOGENESIS (RUP) proteins, which promote reversion of monomer to dimer. Under photoperiodic illumination a dimer/monomer photoequilibrium is established [2]. Hence, factors that influence the photoequilibrium will regulate UVR8 function in natural growth environments.

[1] Jenkins, G. I. (2014) Plant Cell 26:21-37.

[2] Findlay, K. M. W. Jenkins, G. I. (2016) Plant Cell Environ. doi: 10.1111/pce.12724.

notes:

Tissue-specific aspects of different photoreceptor controlled signalling pathways in *Arabidopsis thaliana*

András Viczián[1*], Stefan Kircher[2], Péter Bernula[1], Carlos Crocco[3], Roman Ulm[3], Eberhard Schäfer[2], Ferenc Nagy[1,4]

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Arabidopsis possess numerous photoreceptors what initiate light-dependent signalling cascades and orchestrate expression of hundreds of genes to ensure better fitness. These receptors are expressed in many different plant tissues but our knowledge about the tissue-dependent/independent aspects of their signalling is rather limited. We examined and compared how the far-red sensing phytochrome A (phyA) and the UV-B sensing UV-B RESISTANCE 8 (UVR8) photoreceptor directed pathways depend on the localisation of the receptors. We generated transgenic lines expressing phyA or UVR8 fused to the YELLOW FLUORESCENT PROTEIN under the control of promoters functioning in different tissues in the corresponding mutant backgrounds and developed molecular tools to examine gene regulation at tissue level. ELONGATED HYPOCOTYL 5 plays a key role in the early stage of phyA and UVR8 signalling and its expression is coordinated similarly by both photoreceptors in a tissue-autonomous manner. Our data suggest that a subset of phyA- and UVR8-induced responses are underpinned by tissue-autonomous receptor action whereas inter-tissue signalling is required for complex morphological changes such as inhibition of hypocotyl elongation or development of adult plants.
The work was supported by the Bólyai János Research Fellowship to A.V. and the Hungarian Scientific Research Fund (K-108559 and NN-110636) to F.N..

notes:

The role of blue light and cryptochromes in the regulation of phenolic compound synthesis during the acclimation of *Arabidopsis thaliana* from low to high irradiance

J. Nezval*, M. Štroch, Z. Materová, V. Karlický, V. Špunda, T. Konečná

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Metabolism of phenolic compounds (PheCs) is controlled by PAR and its spectral quality. Whereas high irradiance stimulates the PheCs synthesis through unspecific mechanisms such as enhanced ROS production and altered source/sink status of assimilates, spectral quality affects PheCs specifically through activation of photoreceptors. In this work we focused on the role of blue light and its receptors, cryptochromes 1 (CRY1) and 2 (CRY2), in the acclimation from low to high irradiance. *Arabidopsis thaliana* plants (wild type; WT) and its CRY1CRY2 double mutant were cultivated at low irradiance (LI) of blue (B), green-red (1:1; GR) and white light (W), and then exposed to high irradiance (HI) of the same spectral quality. Our results showed that presence of CRY is not required for HI induced upregulation of PheCs synthesis (at W and GR). However, under B-HI conditions WT plants hyper-accumulate at least six UV-absorbing compounds (most likely PheCs), whereas in CRY mutant the accumulation of PheCs was markedly reduced. Our data indicate that other spectral components of light can be involved in downregulation of B-CRY induced PheCs response to HI (possibly through activation of phytochromes).
Work was supported by projects GAČR (13-28093S), COST (LD14005) and SGS11/PřF/16.

notes:

The importance of cryptochromes, phototropins and UVR8 photoreceptors in the control of plant responses to spectral quality changes in simulated under-canopy conditions

Craig Brelsford, Titta Kotilainen, Saara M. Hartikainen, T. Matthew Robson*

Viikki Plant Science (ViPs), University of Helsinki, Finland

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Plant canopies significantly alter the spectrum of sun light. These changes are perceived by under-canopy plants and utilised to produce photomorphogenic responses that help them to acclimate to the light environment. For instance, blue light is depleted under plant canopies during leaf out but UVB radiation can be relatively enriched. These changes in the solar spectrum are detected by plant photoreceptors which operate over specific wavelength ranges of light.

In wild-type Arabidopsis, blue and UVB had a synergistic effect increasing flavonoid absorbance in the leaf epidermis. The absence of UVR8affected epidermal flavonoids most in the absence of blue light, and surprisingly flavonoids actually decreased in L*er*-*UVR8*$_2$ under UVB! Flavonoid production was not affected by UVB or blue light in *Cry*$_{1,2}$ or *Phot*$_{1,2}$ mutants compared with their respective wild type. Neither mutant exhibited the normal blue-light induced synthesis of flavonoids. There was no effect of Cry$_{1,2}$ Phot$_{1,2}$ or UVR8$_2$ on leaf phenology or growth under the full-spectrum light treatments. However, leaf lamina length was much smaller in the absence of blue light under UVB irradiance, particularly in L*er*-*UVR8*$_2$ and L*er*-*Cry*$_{1,2}$ mutants. (Funded by Academy of Finland Fellowship #266523 M. Robson)

notes:

UV-B signaling related to biosynthesis of phenolic compounds in pea

Jorunn E. Olsen[1,2*], Line Nybakken[2,3], Amsalu G. Roro[1], YeonKyeong Lee[1], Knut Asbjørn Solhaug[2,3], Sissel Torre[1,2]

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2. CERAD, Norwegian University of Life Sciences, Norway
3. Department of Ecology and natural resource management, Norwegian University of Life Sciences, Norway

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In *Arabidopsis thaliana*, COP1 and HY5 are central players in UV-B signaling. Since information about UV-B signaling in other plant species is limited, we aimed to shed light on roles of the HY5 and COP1 homologs LONG1 and LIP1 in pea in UV-B- signaling leading to formation of UV-protecting phenolic compounds. Thus, we analysed levels of UV-B-induced DNA damage products (CPDs) and detailed contents of phenolic compounds in wild type (WT) and long1 and lip1 mutants exposed to UV-B compared to unexposed plants. long1 and lip1 showed higher and lower CPD-levels in response to UV-B than the WT, consistent with their apparent hyper-and hyposensitivity. This was associated with more than twice and about half the level of total phenolic compounds in lip1 and long1 as compared to the WT. lip1 generally contained far higher levels of chlorogenic acid and two specific quercetin-glycosides than the WT, of which only one was UV-B- induced. long1 had lower levels of these quercetin-glycosides and less induction of one of them compared to the WT, but similar chlorogenic acid-content. The results are consistent with LONG1 and LIP1 as UV-B signaling compounds in biosynthesis of phenolic compounds with contents of specific quercetin-glycosides best explaining their differences in UV-B-sensitivity.

notes:

UV4BASIL: morphology, metabolites, and gene expression

Minjie Qian[1,2*], Irina Kalbina[1], Marcel A. K. Jansen[3], Eva Rosenqvist[4], Åke Strid[1]

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2. Department of Horticulture, Zhejiang University, China
3. School of Biological, Earth and Environmental Sciences, University College Cork, Ireland
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UV-B is of interest as a tool for controlling growth and quality of greenhouse-produced plants. Basil (*Ocimum basilicum*) was exposed to 4h UV-B daily for 21 days. Morphological parameters were measured and leaves collected for phytochemical and qPCR analyses. UV-B decreased stem elongation, primarily by inhibiting growth of young internodes. Phenylpropanoids are the main flavour phytochemicals in basil. UV-B increased flavonoid accumulation by ≈20% after 5 days. Expression of genes involved in phenylpropanoid biosynthesis (ObPAL, ObCHS, ObC4H) exhibited diurnal rhythmicity. For ObPAL and ObC4H, transcription peaked at 7 a.m. in control plants, one hour after visible light was turned on. UV-exposure altered the magnitude, but not the timing of the peak. However, two expression peaks were detected for ObCHS; one at 7 a.m. irrespective of UV-exposure, and a separate, larger peak only after UV-B exposure. Expression of ObPAL and ObC4H returned to the basal level quickly after UV-B irradiation, while the increase of ObCHS expression was maintained for a longer period of time. Thus, supplementary UV-B changes plant morphology, phenylpropanoid pathway gene expression, and metabolite concentration that may be determinants of quality of the produce.

This work was supported by the Knowledge Foundation, FORMAS research council, and China Scholarship Council.

notes:

Phototropin mediated ultraviolet-B phototropism in etiolated seedlings

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Low doses of ultraviolet B (UV-B) light have significant effects on plant morphology [1]. In Arabidopsis, many UV-B induced morphological modifications have been ascribed to the UV-B specific receptor UV resistance locus 8 (UVR8). Recent findings in etiolated Arabidopsis seedlings indicate that UVR8 regulated signaling can induce phototropin independent directional bending towards UV-B light [2]. Here, we study the relative contribution of each of these pathways in UV-B regulated phototropism through kinetic analysis of seedlings. The role of phototropins is favored under reduced light conditions and the higher UVR8 response in the UV-B hypersensitive rup1rup2 mutants is interfering with the fast phototropin-regulated phototropic response. Our data suggest that phototropins are the primary receptors for UV-B induced phototropism in etiolated Arabidopsis seedlings, and the RUP-mediated negative feedback pathway prevents UVR8-mediated signaling to affect the phototropin-dependent response. In conclusion, phototropins are the most important receptors for UV-B induced phototropism in etiolated seedlings, and a RUP-mediated negative feedback pathway prevents UVR8 signaling to interfere with the phototropin dependent response.

This work was supported by research grants from the Research Foundation Flanders G000515N and G.0656.13N.

[1] Robson, T. M. et al. (2015) Plant Cell Environ 38 (5):856-66

[2] Vandenbussche, F. et al. (2014) Molecular Plant 7 (6):1041-1052

notes:

Comparing UV research milestones in bryophytes and seed plants

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Bryophytes (hornworts, liverworts and mosses) constitute one of the three evolutionary lineages of plants, together with pteridophytes and seed plants. Some bryophytes were crucial in land colonization by plants, a process in which they had to cope with new and previously unknown environmental factors, such as high UV levels. Were the first responses of bryophytes to UV the same later displayed by seed plants? Or did each group develop specific and divergent responses, in accordance with their structural and physiological peculiarities? We will try to answer these questions on the basis of the knowledge accumulated, but with the limitation of the strong imbalance between the research carried out on each of the two groups. Our comparison will be focused on several milestones of UV research, such as the existence of a comprehensive meta-analysis of the studies conducted on UV responses in each group, the relationship between drought tolerance and UV tolerance, UV biomonitoring, the interactions of UV with other environmental factors, UV photoreception, or the applied aspects of UV. Coincidences and divergences between bryophytes and seed plants will be discussed.

notes:

Contrasting responses of three aquatic bryophytes from mountain streams to sun and shade conditions

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Three bryophytes, two liverworts (*Marchantia polymorpha* and *Jungermannia exsertifolia* subsp. *cordifolia*) and one moss (*Fontinalis antipyretica*), were collected in ten sites (five sun- exposed and five shaded) in mountain streams of the boreal-temperate region, with the aim of studying the physiological differences due to the different solar (and UV) exposure. We measured the ultraviolet absorbing compounds (UVAC) in the soluble (SUVAC) and the insoluble (WUVAC) fractions, both globally by spectrophotometry and individually by HPLC, together with the maximum quantum yield of photosystem II (F_v/F_m) and photosynthetic pigments. Significant differences in F_v/F_m and photosynthetic pigments were found in the three species, with higher F_v/F_m and chlorophyll values under shade conditions. However, regarding UVAC, only liverworts were responsive to solar exposure. In both liverworts, the bulk levels of SUVAC (but not WUVAC), were higher under sun than under shade conditions. In addition, apigenin-diglucuronide in *Marchantia polymorpha* and *p*-coumaroyl-malic acid in *Jungermannia exsertifolia* subsp. *cordifolia* were higher under the sun. Both phenolic compounds have been found to be UV-responsive under controlled UV exposure in the laboratory, and thus UV radiation would be responsible for these specific responses in the field.

notes:

The role of antioxidants in acclimation to UV-B

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Maintaining active photosynthesis in leaves grown under light conditions including both PAR and UV radiation requires increased antioxidant capacities to counterbalance light-induced additional. Such antioxidant responses are complex and include both enzymatic and non-enzymatic pathways. We found that among enzymatic responses H_2O_2 neutralization was particularly activated in tobacco leaves acclimated to supplemental UV-B irradiation in growth chambers [1]. Based on these experiments, a working hypothesis is proposed to explain how the relative extents of UV-induced peroxidase and SOD activation may influence the success of acclimation [2]. Increased polyphenol synthesis is a well documented response to UV, but depending on their chemical structure different phenolic compounds have different potentials to contribute to total and ROS (H_2O_2 and $^1O_2$) specific antioxidant capacities. This is assessed using in vitro assays and is also illustrated by comparing antioxidant profiles of leaves acclimated to various light conditions outdoors [3].

Supported by the Hungarian Scientific Research Fund OTKA (grant number K112309).

[1] Majer,P., Czégény,Gy., Sándor,Gy., Dix,P.J., Hideg,É. (2014) PPB 82:239-243.

[2] Czégény,Gy., Mátai,A., Hideg,É. (2016) Plant Science 248:57-63.

[3] Csepregi,K., Neugart,S., Schereiner,M., Hideg,É. (2016) Molecules 21:2018.

notes:

The role of chloroplast hydrogen peroxide neutralization in the acclimation of leaves to supplementary UV

Gyula Czégény[1*], Petra Majer[2], Dóra Pávkovics[1], Ferhan Ayaydin[3], Philip J. Dix[4], Éva Hideg[1]

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Acclimation to UV-B (280-315 nm) radiation includes keeping cellular ROS concentrations low in order to avoid oxidative damage. Among antioxidants, H_2O_2 neutralization is of special importance, because UV-B may photo-convert this ROS to more oxidizing hydroxyl radicals [1]. Accordingly, we have also shown that the antioxidant defence of tobacco plants against supplemental UV-B is centred on peroxidases [2]. There are several abiotic factors which are known to increase metabolic H_2O_2 production, and a combination of these with solar UV-B may enhance the above process. Because chloroplasts are the primary source of ROS in leaves [3], we studied how the delicate balance between H_2O_2 and peroxidases in chloroplasts is affected by UV-B. To achieve this we tracked plastid H_2O_2 using a fluorescent ROS probe and also examined whether an increase in non-enzymatic H_2O_2 neutralization in chloroplasts lessened the need for peroxidases. In the latter experiment we used transplastomic tobacco plants strengthened in GR/DHAR or GR/GST. Results highlighted the central role of efficient plastid H_2O_2 neutralization in successful acclimation to supplemental UV-B [4].
Supported by the Hungarian Scientific Research Fund OTKA (grant number K112309).

[1] Czégény,Gy. et al. (2014) FEBS Lett. 588:2255–2261.

[2] Majer,P. et al. (2014) PPB 82:239–243.

[3] Asada,K. (2002) Plant Physiol. 141: 391–396.

[4] Czégény, Gy. et al. (2016) JPP – in press

notes:

A biochemical and molecular dissection of fruit anthocyanins in anthocyanin-rich tomato mutant after post-harvest UV-B treatment

M. Santin[1*], S. Catola[1], A. Castagna[1], A. Mazzucato[2], V. Calvenzani[3], K. Petroni[3], C. Tonelli[3], A. Ranieri[1]

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Phenylpropanoid consumption is well-known to be associated with a reduced risk of several human diseases. Many studies demonstrated that UV-B may influence phenylpropanoid metabolism. This work investigates how UV-B radiation can modulate the transcription of different genes involved in the phenylpropanoid pathway, in fruits of the tomato line SA206-1- 2-2 (with the anthocyanin fruit *Aft* gene), characterised by purple spots on fruit surface, and in its wild type, cv Roma. Fruits, harvested at mature green stage, were irradiated with UV-B (1h a day, 6.08 kJ m^{-2} d^{-1}) until red ripe stage. UV-B treatment induced an overall stimulation of the flavonoid biosynthetic pathway in Roma peel. In SA206 peel, early biosynthetic genes (*CHS*, *F3H* and *F3'H*) were down- regulated, leading to a decrease in downstream metabolites. However, *F3'5'H* and *DFR* transcription, as well as delphinidin, petunidin and malvidin levels, increased, indicating a metabolic shift towards anthocyanin synthesis in response to UV-B irradiation.

We are indebted with Prof. Gian Piero Soressi for providing the tomato seeds.

notes:

Flavonoid glycosides in legumes dependent on the cultivar and UV-B

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Legumes such as peas (*Pisum sativum*) are rich in proteins and fiber. Further, value adding components are secondary plant metabolites such as flavonoids that are relevant for humans due to their antioxidant activity. Our study demonstrates that these compounds are in high concentrations in legume leaves f e.g. ready-to- eat pea micro greens. Five pea cultivars cultivars were grown in the greenhouse to determine their genotypic differences. Flavonoid glycoside profiles were measured in methanolic extracts by HPLC-ESI-MSn. Pea leaves contains quercetin as main flavonol aglycone followed by kaempferol They are characterized by quercetin glycosides acylated with hydroxycinnamic acids and their corresponding kaempferol glycosides. The only glycosylated sugar moiety is glucose. However, the pea cultivar Salamanca has the most promising flavonoid glycoside profile for further investigations on the efficiency of UV-B application including high concentrations of quercetin glycosides and the main quercetin glycosides acylated with p-coumaric acid. The focus of following investigations will be the enhancement of the quercetin to kaempferol ratio. Therefore, a second experiment with the summer cultivar Salamanca and the winter cultivar James was conducted. Pea plants were treated with 0.5 kJ m^{-2} d^{-1} for 7 days. After 24 hours acclimation the peas were treated with 6 kJ m^{-2} d^{-1} for 1 hour. The quercetin glycosides of leaves, hulls and seeds of untreated plants were decreased in the winter cultivar James while in the summer cultivar Salamanca the seeds of the untreated plants showed increased quercetin glycosides after post- harvest UV-B treatment. However, pretreatment of plants with UV-B lead to a stabilization of the quercetin glycoside profile of the seeds. Consequently the response of peas to pre- and post-harvest UV-B is dependent on the cultivar and could have a beneficial effect on the quercetin glycosides in the seeds.

notes:

How does C:N stoichiometry affect UV- and PAR-induced accumulation of flavonoids in barley genotypes?

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Flavonoids represent a group of secondary metabolites with important functions in plants grown under biotic and abiotic stress conditions, acting as photoprotective substances, antioxidants and escape valves of excess radiative energy.

Within this study we tested the hypothesis that C:N stoichiometry modulates UV-/PAR-induced biosynthesis of flavonoids. The effects of nitrogen and UV/PAR exclusion were studied in four barley varieties. Nitrogen addition decreased accumulation of UV screening flavonoids particularly in variety Prestige and Bonus and this effect was more pronounced in younger leaves. Close linear relationship was found between C:N ratio and content of epidermal flavonoids. UV radiation positively affected accumulation of isovitexin and kaempferol, whereas PAR induced an accumulation of ferulic acid. Accumulation of kaempferol and homoorientin was strongly genotype-related showing highest contents in variety Sebastian. Both UV/PAR treatment and nitrogen supply affected significantly the root:shoot ratio, which showed a close linear relationship to C:N ratio.

We conclude that a variability in an accumulation of flavonoids is closely related to changes in C:N stoichiometry; however, individual flavonoids showed distinct responses to UV radiation, PAR, nitrogen and barley genotype.

This work was supported by the grant no. LO1415.

notes:

Elevated CO_2 concentration and UV radiation modulate emissions of biogenic volatile organic compounds from European beech saplings

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Biogenic Volatile Organic Compounds (BVOCs; isoprene, terpenes, alkanes etc.) are physiologically relevant secondary metabolites emitted by plants. The synthesis and emission depend on environmental conditions including abiotic factors, particularly temperature and irradiance [1]. UV radiation has a potential to influence a rate and spectrum of emitted BVOCs [2].

To investigate constitutive and stress-induced BVOC emissions saplings of European beech were exposed to ambient and elevated CO_2 concentration (400 × 700 ppm) and altered (reduced × ambient × enhanced) UV radiation under field conditions using glass domes and a modulated lamp system. Emitted BVOCs were sampled on desorption tubes, coupled with gas-exchange measurements of photosynthesis and stomatal conductance, and detected by gas-chromatography with mass-spectrometry. UV radiation significantly reduced BVOC emissions in both CO_2 treated plants. This effect, however, diminished during a prolonged summer drought period and led to an increased UV-stimulated BVOC emissions, particularly in elevated CO_2 plants. The results thus imply that a biosynthesis of BVOCs may substantially contribute to a protection of plants against an oxidative stress.

Work was supported by the grant LO1415 and LD13031.

[1] Loreto, F. Schnitzler, J.P. (2010) Trends in Plant Science 15:154–166.

[2] Guidolotti, G. et al. (2016) Environmental Pollution 208:336–344.

notes:

Effects of UV radiation and rainfall reduction on carbon and nitrogen levels in a Mediterranean shrub community before and after a controlled fire

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This study assesses the role of UV radiation on C and N cycles of a Mediterranean shrubland before and after a fire, and whether this role can be altered by water availability. In a field experiment, naturally growing vegetation was subjected to UV-A+UV-B exclusion, UV-B exclusion or near-ambient UV-A+UV-B exposure in combination with two precipitation regimes (natural or reduced rainfall), along with an experimental fire around the middle of the three years of the study. Different parameters related with C and N levels were measured at soil (0-5 and 5-10 cm), litter and plant level throughout the experiment. UV-A exposure increased soil moisture whereas UV-A+UV-B stimulated soil respiration under reduced rainfall. At 5-10 cm depth, but only before the fire, UV-A exposure increased soil β-glucosidase activity, while UV-A+UV-B reduced it. Mainly under reduced rainfall, plant exposition to UV-B increased foliar C content before the fire and $\delta^{15}N$ in *Arbutus unedo* after the fire. These findings suggest contrasting UV-A and UV-B effects on C and N cycles, often mediated by precipitation levels, together with a homogenizing effect of the perturbation.
We are grateful to: UdG (ASING2011/3), Spanish Government (CGL2010-22283 and CGL2010-18546) and Gavarres Consortium (Girona, Spain).

notes:

Productivity of aquatic ecosystems under the stress of increased solar UV-B and global climate change

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Marine ecosystems rival the biomass production and CO_2 sequestration of all terrestrial ecosystems taken together. Phytoplankton productivity is governed by a number of environmental factors; many of these currently undergo considerable changes due to anthropogenic activities. These factors interact either additively or synergistically. Light availability is an absolute necessity for photosynthesis, but excessive visible and UV radiation reduce productivity and survival. Stratospheric ozone depletion is leveling off and solar UV-B irradiances are expected to return to pre-1980 levels by 2065. But the current enhanced solar UV-B radiation affects phytoplankton especially in polar and mid latitudes. Rising temperatures strengthen stratification and decrease the depth of the upper mixing layer exposing the organisms to higher solar radiation and reduce upward transport of nutrients from upwelling deeper water. Increased terrestrial runoff carrying sediments and dissolved organic matter into coastal waters lead to eutrophication while reducing UV penetration. This effect is augmented by El Niño events. Ocean acidification resulting from increased atmospheric CO_2 concentrations changes the seawater chemistry and affects calcification in phytoplankton, macroalgae and many animal taxa. Ocean warming results in changing species composition and favors blooms of toxic prokaryotic and eukaryotic phytoplankton. Increasing pollution from crude oil spills, persistent organic pollutants, heavy metal as well as industrial and household wastewaters affect aquatic ecosystems, which is augmented by solar UV radiation. Extensive analyses of the impacts of multiple stressors are scarce and a multifactorial analysis of the stress factors on the ecosystem level is urgently needed in the future.

notes:

The role of the UV-B photoreceptor in modulation the physiology and growth of *Arabidopsis thaliana* across a European latitudinal gradient

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The physiology and growth of plants is determined by a suite of environmental conditions but we are yet to fully understand how light and particularly photoreceptors modulate such responses. In this study, we specifically examined the role of the UV-B photoreceptor, UV-B RESISTANCE 8 (UVR8) in determining responses to different climatic factors (including natural UV-B radiation). Seeds of a non-transgenic knock-out mutant, *uvr8-7*, and the corresponding wildtype accession, Wassilewskija, were sown outdoors on the same date in identical substrate along a latitudinal gradient across Europe from 39°N to 67°N.

Growth was monitored weekly from April onwards, climatic data were collected, and flavonoids and glucosinolates were determined. Principal component analysis (PCA) showed that flavonoids clustered together with UV-B radiation and temperature for wildtype but not for *uvr8-7*. Generally *uvr8-7* had less flavonoids than wildtype and in particular quercetin-3,7-O-dirhamnoside was reduced by 70%. The role of UVR8 for the biosynthesis of indole glucosinolates was identified with multivariate generalized linear modeling (GLM) analyses. The results show that UVR8 mediates UV-B- but also temperature-dependent adjustments of vegetative development and modulates flavonoid and indole glucosinolate biosynthesis.

Work was supported by the COST action FA0906 (UV4growth) and the Austrian Science Fund (FWF) (project F3707) to M.-T.H.

notes:

Exploring the mechanisms and functional significance of diurnal changes in UV sunscreen protection in plants

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Diurnal adjustment in epidermal UV-shielding is widespread among higher plants but the mechanisms and functional significance of these rapid changes in UV sunscreen protection are poorly understood. Outdoor experiments were conducted using several cultivated species (*Abelmoschus esculentus* and *Capsicum annuum*) and genotypes of *Arabidopsis thaliana* to test if species differing in diurnal UV protection strategies exhibit differential UV-induced changes in growth and shoot morphology and whether the UV-B photoreceptor UVR8 mediates diurnal changes in UV-shielding. Diurnal changes in epidermal UV transmittance (T_{UV} ; noninvasively measured with the UVA-PAM) were evident in *A. esculentus* but not *C. annuum*, and overall levels of UV protection were higher and less affected by UV exposure in *C. annuum* than *A. esculentus*. However, ambient levels of solar UV (UVB+UVA) reduced shoot height, stem internode length and leaf area in *C. annuum* but had little influence on the morphology of *A. esculentus*. No differences were detected in diurnal changes in T_{UV} between wild type and uvr8 mutants of *A. thaliana*. Results indicate that diurnal changes in UV sunscreen protection are not mediated by the UV-B photoreceptor UVR8 and that greater flexibility in UV-shielding may be linked to reduced sensitivity to UV-induced alterations in growth and morphology.

notes:

Quantifying the role of UV in decomposition of forest litter using litterbags and a trans-European gradient

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Decomposition returns half of all terrestrial carbon fluxes from the biosphere to the atmosphere and controls the pace of ecosystem processes underpinning plant communities. Whilst the co-varying influence of temperature, moisture and substrate quality on decomposition has been extensively studied, the more-nuanced role of UV is not well defined. UV is responsible for litter photodegradation of litter, affects the structure of plants during growth and induces secondary metabolite production in leaves, as well as modifying the leaf microflora during both growth and decomposition. Typically, half of all deciduous forest above-ground productivity is returned to the soil surface as leaf litter. Decomposition of this significant carbon source may be influenced before canopy closure, when early springtime exposure to UV is greatest. Here, we present a rationale for investigating the temporal dynamics of litter decomposition in temperate forests and the role of UV, using a trans- European latitudinal gradient study and litter bag decomposition assays. We also demonstrate how volunteers in a citizen scientist network could deploy litterbag decomposition experiments across woodlands in Europe. Our method utilises perforated screening filters on the upper sides of litterbags, which selectively transmit UV-A and/or UV-B to the litter assay material and allow moisture to circulate. Actinometers supplied with litterbags would measure UV doses, with decomposition rates determined at 4 or 12 month intervals by litter mass loss. Our modelling analysis would control for climatic variables of temperature and moisture, with the influence of litter chemical quality on decomposition quantified via chemical analysis of the litter, or the use of a standardised litter decomposition mix. In delivering this project we would enable a better understanding of the role of UV in forest litter decomposition and develop public awareness of the range of climatic and radiative factors influencing carbon cycling in European forests.

notes:

The spectrum of radiation penetrating deciduous forest canopies

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Light quality and day length, alongside temperature, can be used as signals for spring phenology in the forest understorey, allowing plants to adjust their functional strategies for optimal resource use (light, water and nutrients) to pre-empt flushing by canopy trees. Our aim is to identify the spectral signal that allows understorey plants to coordinate their phenology. Changes in spectral composition occur with seasonal phenological events in forest canopies. Superimposed on these seasonal changes are geographical factors that affect solar irradiance, for instance day length and sun angle at different latitudes. Only by using portable array spectroradiometers calibrated to high definition in the UV regions is it now possible to accurately estimate real-time changes in spectral composition of irradiance across the entire spectrum from UV to IR. We present a set of monitoring data from forests accounting for seasonal changes and geographical differences in solar irradiance reaching the understorey, and use these data to identify tree-species-specific differences. These field measurements are normalised against clear sky data modelled using libRadtran (radiative transfer simulations), to allow for direct comparison among our field measurements. The proportional changes between modelled and measured irradiances can be used to highlight changing spectral cues in forest understories. (Funded by Academy of Finland Fellowship #266523 to M Robson).

notes:

UV-induced changes in plant morphology

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It has long been known that exposure to UV-B radiation can induce changes in plant morphology. However, both underlying mechanisms and the adaptive role of this process remain unclear [1]. In fact, the direction of UV-induced changes in morphology can vary, with most studies revealing a more dwarfed phenotype under UV-B radiation, although others report the opposite. To understand such discrepancies, we have compared the respective effects of UV-A and UV-B on Arabidopsis morphology under both controlled laboratory conditions, as well as under natural sunlight outdoors. Our data show that the UV-A mediated stimulation of expansion growth counters the "dwarfing effect" of UV-B on plant morphology. Consistently, our study failed to reveal UV-B specific morphological responses on Arabidopsis under outdoor conditions, where plants are exposed to a mixture of UV- A and UV-B. Nevertheless, UV-induced morphological changes were observed in the summer, both in wild type Arabidopsis as well as in a uvr8-1 mutant. It is hypothesised that UV-stress induced morphological changes can, under outdoor conditions, be more relevant than UV-B specific (i.e. UVR8-mediated) effects on plant morphology.

Research was supported by Science foundation Ireland

[1] Robson, T.M., Klem, K., Urban, O., Jansen, M.A.K. (2015) Plant Cell & Environment 38: 856-866.

notes:

Ultimate and proximate questions about UV perception by plants

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Proximate questions, or *how* questions, are related to underlying m echanism. Ultimate questions, or *why* questions, are related to the evolutionary origin of these same mechanisms. Understanding the connections between proximate and ultimate causes and a clear assessment of how “agricultural” constraints and breeding selection targets differ from those of natural selection are pre-requisites for the use of genetic modification in crop improvement and for prediction of crop and forest performance under future climate. Knowledge on *how* UVR8, CRYs and PHOTs “work” has improved markedly in recent years. Evolutionary questions related to the functioning of these UV photoreceptors in sunlight remain largely unexplored. I will present hypotheses that when tested will allow for a better understanding of the role of these photoreceptors in adaptation and acclimation of plants' morphology, function and “behaviour” to the changing environment in natural and anthropogenic habitats. Among the questions to be explored are: 1) What information does solar UV radiation carry in different habitats? 2) Have the shapes of the absorption spectra of UVR8 and CRYs become tuned to certain features of the solar spectrum during their evolution? 3) Why complex signalling interactions downstream of these photoreceptors have been favoured by natural selection?

notes:

Different levels of UV radiation and selene treatment affected morphological, biochemical and optical properties of wheat (*Triticum aestivum*)

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The influence of UV radiation and selenium on morphological, biochemical and optical properties and on phytolite concentrations on wheat leaves (*Triticum aestivum*) was studied. Plants were exposed to combination of different treatments; no Se (Se-), added Se (Se+) (10 mg/L in the form of selenate), ambient (UV+) and reduced UV radiation (UV-) using polycarbonate sheets. The influence of the treatments on the optical properties of the leaves was studied by measuring the reflectance and transmittance of the leaves. Treatments affected the thickness of epidermis and cuticula, whereas the stomata were mostly not affected. Plants treated with Se+UV+ had the lowest content of photosynthetic pigments and the highest content of UV absorbing compounds. Se-UV- treatment resulted to lower phytolite content in leaves in comparison to Se+UV+ and Se-UV+ treatment and to higher photochemical efficiency of PSII than in Se-UV+ and Se+UV- treatments. Se-UV- treatment had also higher transpiration rate than Se+UV+ treatment. Leaves of plants treated with Se+UV+ reflected more radiation in all regions of spectra except NIR than plants from other treatments. The leaf reflectance was less affected than transmittance.

Research was financed by Slovenian Research Agency, through the programmes "Biology of Plants" (P1-0212), "Young researchers" (34326) and project J4-5524.

notes:

Phenology, growth and metabolism of *Populus tremula* grown along a natural temperature and UV-B gradient

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Observed and projected warming has provoked research interest on tree phenology in relation to climate. While both ultraviolet-B (UV-B) radiation and warming affect growth and development in plants, the combined effects of the two factors under natural conditions has been little studied. In addition, there is concern for environmental change yielding divergent responses between sexes in dioecious tree species. Here, we present a study of the dioecious Populus tremula grown along an elevational gradient in central Norway where UV-B was also reduced using screening filters, yielding different combinations of temperature and UV- B levels. We studied effects on growth, timing of bud formation and bud break, as well as concentrations of carbon, nitrogen and phenolic compounds. Elevation had a negative effect on plantlet growth, advanced bud set, with effects differing between plant sexes. UV-B attenuation delayed bud formation and enhanced growth for males at the highest elevation, counteracting the effect of low temperature. In addition, elevation and UV-B affected concentrations of different phenolics in stems and leaves. Our data confirm the importance of UV-B as an environmental signal, interacting with other climate factors like warming. The results also add to present evidence of sex-related responses to climatic factors in dioecious plants.

notes:

A trick of the light: UV-B treatments for glasshouse-grown herbs

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Plants perceive the threat of shade from competing vegetation by detection of a reduction in the ratio of Red to Far-Red light (low R:FR), which triggers stem elongation. Over-elongation, which occurs in crowded conditions, can cause lodging and decreases in product quality. UV-B is detected by the UV-B RESISTANCE LOCUS 8 (UVR8) photoreceptor and inhibits elongation even under low R:FR [1]. Glass filters out much of the sun's UV-B radiation. Thus, we are using supplemental UV-B lighting sources to investigate the application of this knowledge to glasshouse grown coriander (*Coriandrum sativum*). We are also examining this effect in the context of the plant circadian clock using the model species *Arabidopsis thaliana* so as to provide treatments that are optimised to plant endogenous rhythms. In this way, we can help our industrial collaborator, Vitacress, find a cost- effective solution to over-elongation in glasshouse-grown potted herbs.
Work is supported by Vitacress and the BBSRC.

[1] Hayes, S., Velanis, C., Jenkins, G., Franklin, K., (2014) PNAS, 111:11894–11899

SEB sponsored participant.

notes:

Suppression of powdery mildew by UV-B radiation in greenhouse roses, cucumber and tomato – effects of additional light and determination of UV action spectra

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Ultraviolet (UV)-B (280 to 315 nm) irradiance at 0.1 to 0.2 W m^{-2} with exposure times from 1 to 2 h or at 1.0 to 1.2 W m^{-2} for 2 to 15 min from UV-B fluorescent tubes significantly suppressed rose (*Rosa* × *hybrida*) powdery mildew (*Podosphaera pannosa*) and cucumber (*Cucumis sativus*) powdery mildew (*Podosphaera xanthii*) via reduced spore germination, infection, severity, and subsequent sporulation of surviving colonies. The UV-B treatments were given during night or in combination with various spectral qualities showed that the suppression was greatest in the presence of background red light, or by a complete lack of background light, and disease suppression was least in the presence of UV-A or blue background light. Exposure of rose plants to 2 h of UV-B during night for 1 week followed by inoculation with *P. pannosa* did not affect subsequent pathogen development, indicating that the treatment effect was directly upon the exposed pathogen and not a result of UV-B induced secondary compounds in the host. However, following 20 to 30 days of exposure, flavonoid content in rose plants was slightly higher in plants exposed to the highest UV-B levels.

Precise action spectra for conidial germination, hyphal length, penetration attempt, and successful infection of tomato powdery mildew, *Oidium neolycopersici*, were examined. Inoculated samples were treated with UV (1.04 ± 0.05 µmol/m²/s) radiation at wavelengths of 250, 260, 270, 280, 290, 300, 310, 320, 350 or 400 nm in the Okazaki large spectrograph in Japan. The effective wavelength range of UV radiation was ≤ 280 nm and this significantly reduced conidial germination, hyphal expansion, penetration attempt and successful infection. There was no effect of UV ≥ 310 nm. Precise action spectra for UV efficiency against *O. neolycopersici* provides the knowledge for efficient disease control in practice.

notes:

Ecophysiological consequences of UV-B radiation and ozone on Brassicaceae resistance traits

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In nature higher UV-B radiation often appears together with increased ozone concentration. Therefore, UV-B and ozone mediated changes on secondary metabolites in Brassicaceae were investigated along with consequences for plant resistance against insects and pathogens. In our first experiments with *Arabidopsis thaliana* we found that ecological relevant low to moderate UV-B doses elicited especially the accumulation of 4-methoxy-indol-3-ylmethyl glucosinolate, 4-methylsulfinylbutyl glucosinolate, and camalexin in Columbia wild-type. The UV-B mediated effects were further investigated with mutants of the UV-B receptor, *uvr8-6* [1], a UV-B responsive ubiquitin ligase, a*ri12-2* [2], and the novel cap binding protein, *ncbp* [3]. A low daily dose of 0.2 kJ m^{-1} UV-B_{be} during one week and ozone exposure (65 and 250 ppb) had different effects on the performance of the insects *Spodoptera exigua* and *Pieris brassicae*, but promoted susceptibility to the fungal pathogen *Botritis cinerea* and *Alternaria brassicicola*. UV-B and ozone induced changes on glucosinolates, phenolics, and carotenoids will be presented in the light of UV-B perception.

[1] Favory, J.-J., Stec, A., Gruber, H., Rizzini, L., Oravecz, A., Funk, M., Albert, A., Cloix, C., Jenkins, G.I., Oakeley, E.J., Seidlitz, H.K., Nagy, F., Ulm, R. (2009) EMBO J. 28:591–601.

[2] Xie, L., Lang-Mladek, C., Richter, J., Nigam, N., Hauser, M.T. (2015) Plant Physiol Biochem.93:18-28.

[3] Ruud, K.A., Kuhlow, C., Goss, D.J., Browning, K.S. (1998) J Biol Chem. 273:10325-10330.

notes:

Dose- and time-dependent effects of ultraviolet light on tomato resistance to western flower thrips

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Ultraviolet (UV) light plays a crucial role in plant-herbivore interactions by modulating constitutive and inducible plant defenses. In particular, UV-B can induce production of trichomes and leaf phenolics, and augment jasmonic acid-mediated plant defense responses. This overall may reinforce plant protection against arthropod pests. We investigated whether supplemental UV light can enhance tomato (*Solanum lycopersicum*) protection against western flower thrips (*Frankliniella occidentalis*), a key pest worldwide. We looked at the effect of different daily UV doses on thrips resistance and determined the dynamics of this induction using time course experiments. We assessed the UV effect on: silver damage symptoms caused by thrips feeding, defense-associated leaf glandular trichomes and their allelochemicals, leaf phenolic content and plant growth parameters. We observed a strong, dose dependent, positive effect of UV light on tomato resistance against thrips. Plant growth was not altered by UV- treatments. Production of glandular trichomes and their exudates, nor leaf phenolics were affected. Our results highlight the potential of UV light as a promising method for thrips control in tomato.

This research was supported by STW Perspective program “Green Defense against Pests” (GAP) (Ref. 13553), and the companies involved in the project: Rijk-Zwaan, Deliflor Chrysanten, Dekker Chrysanten, Fides and Incotec.

notes:

ABSTRACTS OF POSTER PRESENTATIONS

Does UV-B radiation influence the allergenicy of pollen from common ragweed (*Ambrosia artemisiifolia*)?

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Common ragweed (*Ambrosia artemisiifolia*) is an invasive neophyte from Northern America and starts spreading within Europe about 100 years ago by contaminated seed shipments. The pollen has a very high allergenic potential and recent studies show an impact of climate change parameters (increased CO_2 concentrations, drought) and air pollution (ground level O_3, NO_x) on the growth and flowering period of ragweed, as well as the allergenicity of its pollen [1].

Recent experiments revealed that pollen cell wall components are changed in plants grown under elevated O_3 [2]. CO_2 and drought treatment resulted in increased allergen transcript level [3] and the allergenic protein level was increased under elevated NO_2 conditions [4].

The aim of our new experiment is to clarify the effect of the long-distance transport of ragweed pollen up to high altitudes with increasing UV-B radiation on its allergenicity.

[1] Breton, M.-C., Garneau, M., Fortier, I. et al. (2006) Science of The Total Environment 370:39-50

[2] Kanter, U., Heller, W., Durner, Jet al. (2013) PLoS ONE 8(4):e61518

[3] El Kelish, A., Zhao, F., Heller, W et al. (2014) BMC Plant Biology 14:176

[4] Zhao F., El-Kelish A., Durner, J., et al. (2016) Plant Cell Environment 39:147-164

notes:

'R4Photobiology' suite: Using R for photobiological calculations

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The R packages in the R4Photobiology suite implement data import, calculations and plotting related to handling of spectral and summary radiation data as used in photobiology, plus some additional functions for day length and sun position calculations. The main aim is to make it easier for biologists to quantify and describe the visible and ultraviolet radiation conditions used in experiments or monitored in nature, in a standardized and consistent way. In the spirit of reproducible research the interface, is not visual or menu based, and all functionality is available in scripts. My design is based on the idea of mirroring in the software as much as possible the "concepts" used in the user domain, photobiology and radiation physics. The design is based on a core package and additional packages providing data examples and functions for specific fields, in the hope that contributions will in the future expand the usefulness of the suite. Plotting functions are built using package 'ggplot2' as basis, but they are isolated in a package, making parallel future implementations based on other plotting "systems" possible. An object oriented design is used. The capabilities of the packages will be described, and examples of their use will be presented.

Work supported by The Academy of Finland (decision 252548).

notes:

Carotenoid content of persimmon fruit exposed to UV-B radiation

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Many studies have elucidated the important role of carotenoids in promoting human health due to their high antioxidant properties. The consumption of these compounds via carotenoid-rich foods has proven to be inversely correlated to the incidence of chronic diseases. This work aimed at evaluating the effectiveness of post-harvest UV-B treatment in order to improve carotenoid content in persimmon fruits. The fruits were harvested at commercial maturity and placed into climatic chambers equipped with UV-B lamps (1.69 W.m-2). This radiation was applied for 48 hours and fruits were sampled at 24, 36 and 48 hours on each treatment. Control fruits were keeped in the same condition without UV-B radiation. HPLC analysis was performed to separate and identify carotenoid compounds. From 36 hours was observed a stimulation of carotenoid synthesis, with the major component -cryptoxanthin undergoing the highest increase (+41.56%) at 48 hours of UV-B treatment. Total carotenoid content varied from 346.28 mg.kg-1 at time zero to 374 mg.kg-1 after 48 hours of UV-B radiation. The results presented in this work indicate that irradiation with UV-B in post-harvest is an effective tool to modulate the concentration of health-promoting compounds in persimmon fruits.

Work was supported by Capes (71/2013 CsF-PVE, Bilateral agreement Brazil-Italy)

notes:

The role of various leaf polyphenol groups in sunlight acclimation of grapevine

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Polyphenolic compounds represent a large class of secondary metabolites with documented UV absorbing and antioxidant properties. We compared sunlight-acclimated leaves collected at different phenophases (characterized according to berry development as pea berry size, veraison and technological ripeness) from different concultas (Red, White and Variable) of the Gohér cultivar of grapevine (*Vitis vinifera*). Specific responses to solar UV were studied by comparing leaves grown under UV excluding plastic filters and UV transparent cellulose-diacetate filters as control. HPLC measurements identified caftaric acid as the major phenolic acid and glycosylated quercetin derivatives as main flavonoid components in addition to smaller amounts of various kaempferol derivatives. Antioxidant capacities were assessed using Trolox equivalent antioxidant capacity (TEAC), Ferric ion reducing antioxidant power (FRAP) and DPPH radical neutralization assays. UV absorbing capacities were determined using leaf extracts. In contrast to kaempferols, amounts of quercetin derivatives showed strong correlation with FRAP and DPPH. Kaempferol-3-o-glucuronide content, however, showed good correlation with UV absorbing ability; while caftaric acids had a significant correlation with leaf total antioxidant capacity values.
Supported by the Hungarian Scientific Research Found (OTKA K-101430).

notes:

Role of solar UV radiation in grapevine leaf physiology and berry composition in a Mediterranean environment

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Most of the studies addressing the response of grapevine physiology and berry composition to UV radiation have been carried out on high-altitude vineyards or controlled scenarios. However, further experimentation is needed in vineyards located at lower altitudes, where most of worldwide grapevines are grown. In this study, we evaluated the effects of ambient UV exclusion on leaf physiology, and berry and leaf phenolic composition, of Tempranillo grapevines (*Vitis vinifera*) grown under mid-altitude Mediterranean conditions. Grapevines were subjected to three UV treatments (no filter, UV-transmitting filter, and UV-blocking filter) in a completely randomized block design from flowering until harvest. UV absence hardly influenced F_v/F_m and photosynthetic pigments, but both net photosynthesis rates and stomatal conductance were stimulated. Bulk levels of phenolic compounds in the vacuoles and cell wall fractions of leaves and berry skins were not affected by the radiation treatments. Increased accumulation of glycosilated flavonols in the vacuolar fraction of berry skins was the most remarkable result of UV exposure, with lesser impact on the accumulation of anthocyanins, flavanols, stilbenes and hydroxycinnamic derivatives. In conclusion, natural UV levels at Mediterranean conditions seem to be a “good stress” factor, defined as an activating, stimulating stress, positive for plant development.

notes:

Effects of experimentally increased UV radiation and reduced watering on the growth and physiology of two Mediterranean resprouter species before and after pruning

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Effects of supplemented UV radiation and reduced watering were evaluated in Arbutus unedo (Au) and Quercus suber (Qs). Seedlings of Au and Qs were grown for 7 months in pots outdoors with enhanced UV-A+UV-B, enhanced UV-A or ambient UV, combined with two watering conditions, field capacity (WW) or 20–40% watering reduction (LW). After this first period of growth, aerial biomass was removed and resprouts were grown under the same conditions for a further 7 months. In both species, pruning and watering regime affected most of the analysed leaf and root biometric, morphological, physiological and biochemical parameters, whereas UV radiation only affected a few of them. For Qs, enhanced UV-A+UV-B decreased leaf area while enhanced UV-A increased LMA. Moreover, only in Qs seedlings, supplemented UV-A increased the leaf/root mass ratio and photosynthetic rates (A), while enhanced UV-A+UV-B affected positively Fv/Fm. After resprouting, enhanced UV-A+UV-B decreased the phenolic/starch ratio of Qs roots. For Au resprouts, leaf relative water content and A were higher in LW than in WW plants when grew under enhanced UV-A+UV-B. Hence, Au and Qs were more sensitive to watering reduction and pruning than to UV radiation enhancement.
We thank: UdG (ASING2011/3), Spanish Government (CGL2010-22283 and CGL2010-18546) and Gavarres Consortium (Girona, Spain).

notes:

Alternative splicing of *At4g25290*, a putative photolyase, changes its subcellular localization

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At4g25290 encodes a protein with a putative photolyase activity. It contains two domains: N-terminal photolyase and a C- terminal hydrolase. However, the analysis of mRNA isolated from leaves reveals that alternative splicing results in expression of proteins which lack one of these domains. Here we characterize three splicing isoforms of At4g25290. The shortest one has only the photolyase domain. The longer isoform, may use an alternative start codon, as compared to full length At4g25290. Depending on the start of translation it encodes a hydrolase or a photolyase domain. The photolyase domain is active in full length and At4g25290 alternative splicing isoforms, as these proteins expressed in photoreactivation deficient E.coli restore bacteria viability after UV treatment, when illuminated with photo-reactivating light. Alternative splicing changes the localization of At4g25290. Full length At4g25290 localizes in chloroplasts and at the plasma membrane. The shortest isoform shows miss-localization and forms clumps at the plasma membrane and in the cytoplasm. The longer one containing the photolyase domain, is found in the nucleus, at the plasma membrane and in chloroplasts. The hydrolase domain localizes at the plasma membrane and nucleus.
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notes:

Balancing between H_2O_2 generation and neutralisation during acclimation to UV-B

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According to a recently proposed model, successful acclimation to UV-B requires H_2O_2 as a signalling molecule [1]. On the other hand, the possibility of H_2O_2 photo-conversion to the highly reactive and toxic •OH by UV-B poses some hazard [2]. In order to study whether H_2O_2 concentrations are kept low in leaves acclimated to UV-B without losing photosynthetic activity, we measured antioxidant enzyme activities and ROS concentrations in tobacco leaves kept under different PAR (40 - 140 µmol m^{-2} s^{-1}) and supplemental UV-B (5.04, 6.72 and 8.39 µmol m^{-2} s^{-1}) for 4 days in growth chambers. In leaves acclimated to these light conditions both H_2O_2 concentration and peroxidase activity increased (2.5 and 1.3 fold as compared to controls, respectively) and was positively correlated to UV-B exposure. Similarly to earlier studies [3], SOD activities did not show the same increase as peroxidases. Present results demonstrate that despite UV-B induced higher peroxidase activities cellular H_2O_2 levels increase in UV-B exposed leaves.
Supported by the Hungarian Scientific Research Fund OTKA (grant number K112309).

[1] Müller-Xing,R., Xing,Q., Goodrich,J. (2014) Front. Plant Sci. 5: 474.
[2] Czégény,Gy., Wu,M., Dér,A., Eriksson,L.A., Strid,Å., Hideg,É. (2014) FEBS Lett. 588:2255-2261.
[3] Majer,P., Czégény,Gy., Sándor,Gy., Dix,P.J., Hideg,É. (2014) PPB 82:239-243.

notes:

Specific and environmental determination of ultraviolet-absorbing compounds and anatomical characteristics in mosses from Venezuelan Andes

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UV-absorbing compounds (UVAC) have been studied in bryophytes of diverse geographical provenances, but tropical countries, and particularly high tropical mountains, have been underexplored regarding this aspect. In addition, the anatomical responses of bryophytes to radiation in those habitats have also been underexplored. Our aim was to analyze the specific and environmental determination of UVACs and gametophore anatomy in 10 mosses collected in habitats with different canopies and altitudes (2964-4394 m) in Venezuelan Andes. We measured the bulk levels in both the soluble (SUVAC) and insoluble (IUVAC) fractions, the individual UVACs, the Sclerophylly Index (SI) and several anatomical characteristics. A great interspecific variability was found in the bulk levels of UVAC, although the level of IUVAC was higher than the level of SUVAC in all the species. Sun samples generally showed higher bulk levels of SUVAC and IUVAC, and were more sclerophyllous, than shade samples. Only SUVAC responded to altitude, with higher values at higher altitudes. We identified two flavonoids, derivatives respectively of kaempferol and apigenin, whose concentration was different between sun and shade samples. Gametophore length, cell size, stem diameter, leaf length and (when present) hyaline point length, were found to be radiation-responsive variables.

notes:

UV-B resistance strategies of green macroalgae

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A fundamental UVB resistance strategy of plants is screening by protective pigments. The obvious advantage of this strategy is to avoid penetration of harmful radiation in the leaf tissues and hence the induction of damage. Mutants of higher plants with defective synthesis of UVB screening pigments are not vital under UVB irradiation [1]. In contrast, many green macroalgae do not display UVB screening [2] although regular UVB exposure can be observed in their natural habitat. In only in one of six orders, the Cladophorales, we detected efficient UVB screening [3]. The cell wall located compounds responsible for the screening are currently under investigation. Remarkably, the ecologically very successful order of the Ulvales apparently does not employ screening compounds. In UVB exposure experiments the non-screening species *Ulva clathrata* showed accordingly stronger DNA and photosystem II damage than the screening Cladophorales species *Rhizoclonium riparum* [4]. However, *Ulva* spec. thalli sampled *in situ* from direct sunlight did not contain DNA dimers and or irreversibly damaged PS II centres [5]. Obviously, under field conditions *Ulva* is able to employ efficiently other UVB resistance strategies than screening. One such strategy may be rapid photoreactivation of DNA dimers and repair of photosystem II.

[1] Lois, R., Buchanan, B. B: (1994) Planta 194:504-509

[2] Karsten, U., Sawall, T., Hanelt, D., Bischof, K., Figuerora, F. L., Flores-Moya, A., Wiencke, C. (1998) Botanica Marina 41:443-453.

[3] Pescheck, F., Bischof, K., Bilger, W. (2010) Journal of Phycology 46:444-455.

[4] Pescheck, F., Lohbeck, K., Roleda, M., Bilger, W. (2014) Journal of Photochemistry and Photobiology B:Biology 132:85-93.

[5] Pescheck F., Campen, H., Nichelmann, L., Bilger, W. Marine Ecology Progress Series (under revision)

notes:

Comparison of three assays measuring horseradish peroxidase activities in UV-B exposed tobacco leaves

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Solar UV-B (280-315 nm) facilitates hydrogen peroxide (H_2O_2) photoconversion to hydroxyl radicals ($^{\bullet}OH$) [1], thus a peroxidase centered antioxidant defence is needed for a successful acclimation to UV-B [2]. There are several methods utilizing different substrates for measuring total peroxidase enzyme (POD, EC 1.11.1.7) activities in leaf samples. UV-B acclimation responses are expected to affect different isoenzymes of this large family of class-III peroxidases differently. We investigated whether, three substrates commonly used in POD assays, such as ABTS, guaiacol and *o*-phenylenediamine tracked UV-B-induced changes in enzyme activities similarly.

To investigate this possible difference, 6 weeks old tobacco plants were exposed to 2.94 UV-B W m^{-2} for 4 days (4 hours per day) supplementing 140 µmol m^{-2} s^{-1} PAR in a growth chamber. Plants acclimated to these conditions well, and photochemical yields were not affected by UV-B. POD activities increased in response to UV-B, however the above substrates registered different extents.

Since the actual ratio of UV-treated/control POD activities is critical to the success of acclimation [3], our results suggest caution when choosing assay conditions.

Supported by the Hungarian Scientific Research Fund OTKA (grant number K112309).

[1] Czégény,Gy., Wu,M., Dér,A., Eriksson,L.A., Strid,Å., Hideg,É. (2014) FEBS Lett. 588:2255-2261.

[2] Majer,P., Czégény,Gy., Sándor,Gy., Dix,P.J., Hideg,É. (2014) PPB 82:239-243.

[3] Czégény,Gy., Mátai,A., Hideg,É. (2016) Plant Science 248:57-63.

notes:

Are changes in solar irradiation and spectral composition reflected in leaf pigment dynamics of the forest understorey species?

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The light environment experienced by forest understorey species changes from early spring to summer due to the flushing of canopy trees. Many understorey plants coordinate their phenology to best utilise the favourable light conditions before canopy closure. Understorey plants utilise spectral changes such as red/far-red ratio as a signal to adjust their growth, but much less is known about understorey plants interactions with UV radiation, especially at realistic doses of radiation. In order to understand more about the possible light signals forest understorey species perceive during the spring, we aim to understand what changes occur outside the visible spectrum of radiation. The measurement of solar UV and secondary metabolites, produced by plants in their leaves in response to UV radiation, allows us to study relationship between solar radiation and leaf flavonoids in situ.

Most of the over-50 understorey plant species present in our Lammi sites had a trend of declining UV-screening flavonoids during the growing season. The UV-screening of most understorey plants species tended to follow a similar pattern to change in absolute UV irradiation. However plants had fine-tuned species- and site-specific changes. (Funded by Academy of Finland Fellowship #266523 M. Robson, and Grant from the Region of Normandy to M Pieriste & E. Forey)

notes:

UVR8 and CRYs regulate transcriptome changes in *Arabidopsis thaliana* leaves exposed to solar UV and blue radiation

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The UV-B photoreceptor UV RESISTANT LOCUS 8 (UVR8) and the UV-A/blue photoreceptors CRYPTOCHROME 1 and 2 (CRY 1, 2) play key roles in regulating photomorphogenesis and acclimation. However, information on the molecular mechanisms regulated by UVR8 and CRYs in sunlight is scant. An experiment was designed, where *Arabidopsis thaliana* wild-type Landsberg erecta (Ler) and photoreceptor mutants *uvr8-2* with functional CRYs and *cry1cry2* with functional UVR8 were exposed outdoors for 6 hours under filters to study responses to solar UV-A, UV-B and blue radiation. Roles of UVR8 and CRYs on the regulation of the transcriptome were assessed with RNA sequencing and verified with quantitative real time PCR. Differential gene expression analysis showed that in Ler, a larger proportion of genes responded to blue than to UV-A and UV-B. In *uvr8-2*, of all the genes responding to any of the radiation treatments, 93%, 10% and 1.7% of genes responded to blue, UV-A and UV-B respectively; whereas in *cry1cry2*, 3%, 37% and 75% of genes responded to blue, UV-A and UV-B respectively. Interestingly, that half as many genes responded in *cry1cry2* to UV-A than to UV-B suggests that UVR8 could play a role in the perception of solar UV-A along with other photoreceptors.

notes:

Effects of UV-B post-harvest treatments on enzymes involved in cell wall plasticity of peach fruit (cv. Fairtime)

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To date, many studies have shown that UV-B radiation can selectively improve the nutraceutical value of several fruits. On the contrary, few researches investigate the effect of UV-B exposure on the plasticity of cell wall that is responsible for the softening process during shelf life of fruits. This process can vary significantly, according to both UV-B treatment and the fruit species or cultivar. In this study, melting flesh yellow peaches (*Prunus persica* cv. Fairtime) were exposed for 10 min or 60 min to UV-B radiation (2.31 W m^{-2}). Afterwards, the fruits were kept at room temperature up to 36 hours. The activity of some cell wall enzymes, e.g. peroxidases, endo-polygalacturonase, β-galactosidase, endo-1,4-β-D-glucanase/β-D-glucosidase and pectin methylesterase was quantified at different time points. Data will be discussed considering both UV-B treatments and the following storage time points.

notes:

What function do pigment absorption measurements really serve?

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Leaf pigment absorption spectra are routinely used by ecologists as functional response traits. Quantitative information is gathered using spectrophotometric analyses of biochemical extracts in solvents that involves the harvesting of leaves; whereas repeated non-destructive measurements of the same leaf using portable 'leaf-clip' devices are used to obtain functional absorbance and time-series data. Many efforts have been made to understand the relation between absolute pigment content of the leaf and the absorbance values produced by non-invasive measurements, and to overcome the difficulties in comparability of the results, by establishing calibration curves for non-invasive measurements. However, use of these has been problematic as their comparability depends on leaf anatomical characteristics and variability among devices.

We tested variation among 'identical' DUALEX Sci+ devices and DUALEX3 and SPAD-502 devices; species specificity and wavelength dependency of the relationships, & their consistency among equivalent plants grown under different conditions.

The relationship of absorbance measured with the devices and from leaf extracts remains consistent in plants grown under different conditions, meaning that plant growth under different treatments in an experiment can be legitimately compared without concern for potentially confounding factors. (Funded by Academy of Finland Fellowship #266523 M. Robson)

notes:

Effects of UV radiation on growth in lichens

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Lichens are normally well protected against ultraviolet (UV) radiation. They may even survive outer space conditions. The cortex of lichen thalli screen UV-B radiation efficiently and photosystem II efficiency (Fv/Fm) of the photobiont is normally not affected by natural solar UV-B levels. However, the effects of UV on growth in lichens has rarely been studied. In a growth chamber experiment with *Lobaria pulmonaria, Peltigera apthosa* and *Cetraria islandica* the thalli exposed to UV from QPanel UVB313 tubes screened with cellulose acetate had significantly lower relative growth rates (RGR) than thalli exposed to visible light only. However, maximal photosystem II efficiency (Fv/Fm) was not reduced by UV for any of the species.

A field experiment was done with *L. pulmonaria* and *Lobaria virens* with three screening treatments: 1) full solar radiation with sunbed UV-transmitting Plexiglas, 2) UVA + visible light with UV-B blocking polyester film and 3) visible light only with UV-blocking polycarbonate Plexiglas. The thalli receiving visible light without UV had much higher RGR than thalli exposed to visible light + UV-A, whereas thalli exposed to full solar radiation had lowest RGR. However, there were small differences only in Fv/Fm between the different UV treatments, and thalli exposed to the different UV treatments had almost similar light response curves of photosynthetic CO_2 uptake.

notes:

Representative diurnal course of UV-A + UV-B irradiance above canopy in Hungarian vineyard

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A well-documented UV-induced response is the synthesis of secondary metabolites, including those of the phenylpropanoid pathway, which are effective UV-absorbing sunscreens (antioxidant activity) of grapevine leaves and berries. The susceptibility to UV radiation and the impact on grapevine performance vary among cultivars and depend mainly on latitude, irradiation level, wavelength and duration of the exposure (daily course). Only a few studies have taken into consideration broadband UV radiation at the canopy level and its interaction with phenological stages of grapevine.

Our study aims to analyse the diurnal course of natural broadband UV radiation (UV-B + UV-A) and its relationship with beginning of vine's phenological stages. Measurements were conducted using an automatic weather station WS-600 (Lufft GmbH., Germany), which was complemented a broadband UV radiometer CUV5 (Kipp&Zonen B.V., The Netherlands). The research site (University of Pécs) is situated on the south-facing slopes of Mecsek Hills, in Hungary (latitude: 46°07' N, longitude: 18°17' E, 200 m a.s.l.). Our investigation based on processing average diurnal course of broadband UV data in each month during three consecutive years (between 2013 and 2015).

Results of this representative diurnal course of UV radiation at grapevine canopy level provide basic and additional information for the successful plant physiological experiments and timing of different canopy management technologies.

notes:

What role does UV radiation play in influencing plant litter decomposition and biogeochemistry in coastal marsh ecosystems

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Decomposition is a crucial component of global biogeochemical cycles that influences the fate and residence time of carbon and nutrients in organic matter pools, yet the processes controlling litter decomposition in coastal marshes are poorly understood. We conducted several field studies to examine what role UV plays in the decomposition of the standing dead litter of *Sagittaria lancifolia* and *Spartina patens*, two common species in marshes of intermediate salinity in southern Louisiana, USA. Over one growing season, *S. lancifolia* litter exposed to ambient UV had significantly less mass loss compared to litter exposed to attenuated UV over the initial phase of decomposition (0-5 months) then treatment effects switched in the latter phase of the study (5-7 months). Similar results were found in *S. patens* over an 11-month period. UV exposure reduced total C and N in remaining tissue with treatment differences most pronounced in *S. patens*. Phospholipid fatty-acid analysis indicated that UV altered bacterial biomass and bacteria:fungi ratios associated with *S. lancifolia* litter. Results indicate that solar UV can have both positive and negative net effects on litter decomposition in marsh plants and suggest that photodegradation represents a potentially significant pathway of C and N loss from these coastal ecosystems.

notes:

UV radiation causes leaf and DNA damage in Pisum sativum grown in high relative air humidity

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UV radiation can be used as a tool to control plant growth and morphology, pests and diseases in greenhouse production. In this study we show that the aerial environment have an effect on the plants sensitivity to UV-B. In *Pisum sativum* exposed to UV-B we found leaf curling in both high (90%) and moderate (60%) relative air humidity (RH). However, there were significantly more leaf curling, chlorosis and necrosis in high RH with UV radiation compared to moderate RH with UV. We quantified the amount of CPD-DNA damage and found significantly more CPD-DNA damage in the leaves from high RH with UV radiation, while there was very little CPD-DNA damage in the other treatments. Plants treated with UV radiation showed reduced transpiration during growth. After moving the plants to dry air (40% RH) plants given the UV treatments still had lower transpiration than their counterparts. However, the opposite results were found when detached leaves were studied. This shows that UV-B radiation can cause unwanted injuries under certain conditions and change the water balance of the plants. The contents of phenolic compounds in response to air humidity and UV-B will be discussed.

notes:

Total exclusion of solar UV down-regulates the early steps of flavonoid biosynthesis and changes non-photochemical quenching in *Vitis vinifera* cv. Olaszrizling leaves

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In order to study the effects of solar UV-B on the regulation of secondary metabolites, three years old *Vitis vinifera* cv. Olaszrizling cuttings were grown in pots in a natural environment. Horizontally trained vines were covered by either UV-screening (UV^{-}) or UV-transparent filters (UV^{+}) and leaves and berries developed under these conditions were studied at the end of summer.

UV^{-} leaves had lower CO_2 uptake and stomata conductance than UV^{+} leaves, although there was no significant difference between PSII photochemical yields. UV^{-} leaves featured higher regulated (Y(NPQ)) and lower non-regulated (Y(NO)) non-photochemical quenching than UV^{+} leaves. UV^{-} leaves contained less flavonoids, and we found that this was due to down-regulation of genes regulating the early events of polyphenol biosynthesis. Differences in energy partitioning may be explained by UV-inducible variance in metabolic pathways: In UV^{+} leaves increased synthesis of leaf polyphenols may divert resources from xanthophyll based Y(NPQ) and increased antioxidant capacities may be reflected in higher Y(NO). The latter may also be reflected in lower leaf H_2O_2 concentrations were found in UV^{+}.

Must prepared from UV^{+} berries had higher soluble solids concentrations (SSC) and sugar content (°Brix).

Supported by the Hungarian Scientific Grant Agency (OTKA K101430).

notes:

Differential dynamics of flavonoid biosynthesis and accumulation in six medicinal herbs under full sunlight exposure

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The dynamics of epidermal flavonoid ($_{ep}$Flav) induction was monitored during 11 days in the leaves of three *Ocimum basilicum* varieties: Americanum, Genovese and Purpurescens, *Salvia officinalis*, *Eruca sativa* and *Verbascum thapsus* previously grown in a glasshouse (receiving 16% of sunlight irradiance without UV). At full sunlight plants received mean daily doses of 6.97 MJ m^{-2}, 0.86 MJ m^{-2} and 22.46 kJ m^{-2} in the photosynthetically active radiation, UV-A and UV-B wavelengths, respectively. Although constitutive concentration of $_{ep}$Flav was similar, dynamics of their induction was species-specific. Significant increase in $_{ep}$Flav accumulation was observed 30h after exposure to sunlight in all species except *O. basilicum* var. Purpurescens, in which the increase was delayed. This delay was correlated with induction of constitutive epidermal anthocyanins. Total leaf flavonoids were unchanged, in contrast to epidermal, emphasizing their UV-B absorbing function. Total antioxidative capacity increased at least 2-fold under sunlight, which was in accordance with total phenolic increase. Leaf dry biomass was 50-100% higher in sunlight-exposed compared to glasshouse grown plants, while fresh biomass was unchanged, indicative of leaf thickening. We showed that flavonoids accumulation was dependent on light conditions and constitutive pool of UV-B absorbing compounds.
Work was funded by MoETDS (III43010).

notes:

6-4 PP photolyase encoded by AtUVR3 is localized in chloroplasts, mitochondria and nuclei

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UVB irradiation leads to the formation of dimers between adjacent pyrimidines in the DNA strand. Among them are pyrimidine(6-4)pyrimidones or 6-4 photoproducts (6-4 PPs) [1]. In plants these are repaired mainly by specialized enzymes, photolyases, which use UVA/blue light energy for splitting dimers. In Arabidopsis one gene coding 6-4PP photolyase activity, named AtUVR3 was described so far [2]. The steady state level of the AtUVR3 transcript was down-regulated by visible light and dependent on photosynthesis-delivered signals. It is also down-regulated by UVB in a UV resistance 8 (UVR8) independent manner. The C-terminal part of protein is responsible for the nuclear, nucleolar, chloroplast and mitochondrial localization of the protein. UVB irradiation caused the changes in intranuclear localization of UVR3. Whereas in non-irradiated leaves this photolyase was localized mainly in nucleolus, after UVB treatment it translocated to places of 6-4 PPs formation and appeared as a 3D filamentous structure. FRAP analysis showed that UVR3 motility was decreased after UVB irradiation, when it bound to 6-4PPs. Work was supported by Polish National Science Centre grant no. UMO-2011/03/D/NZ3/00210

[1] Mitchell, D.L., Nairn, R.S. (1989) Photochem Photobiol. 49:805–819
[2] Nakajima, S. et al. (1998) Nucleic Acids Res. 26, no. 2: 638-644

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