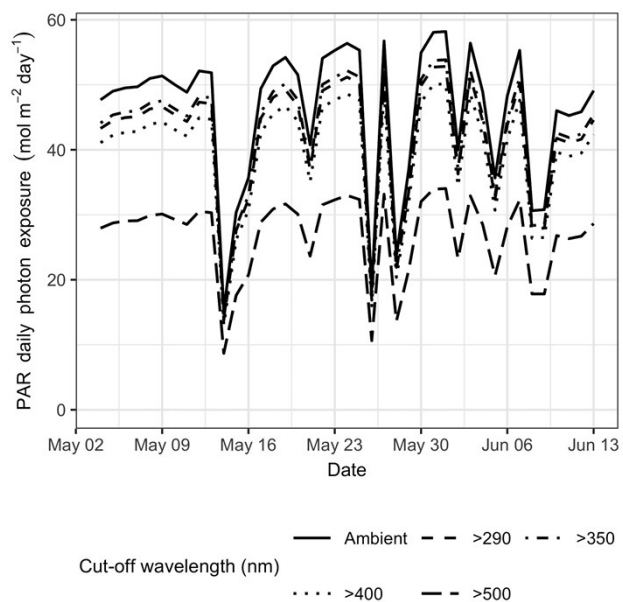
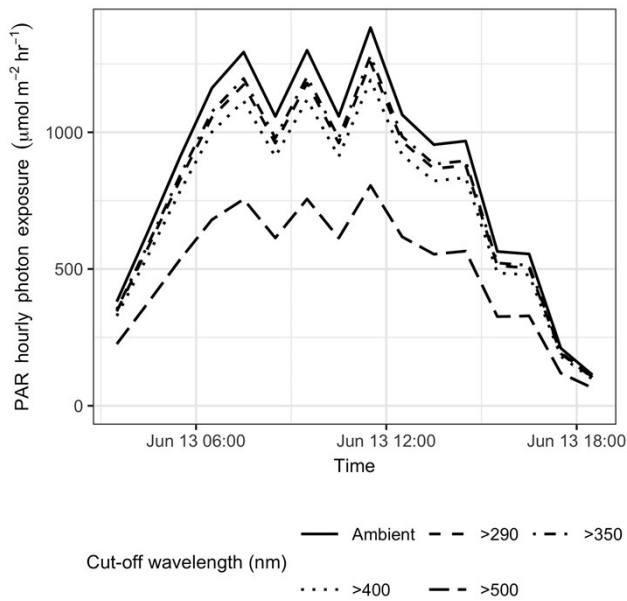


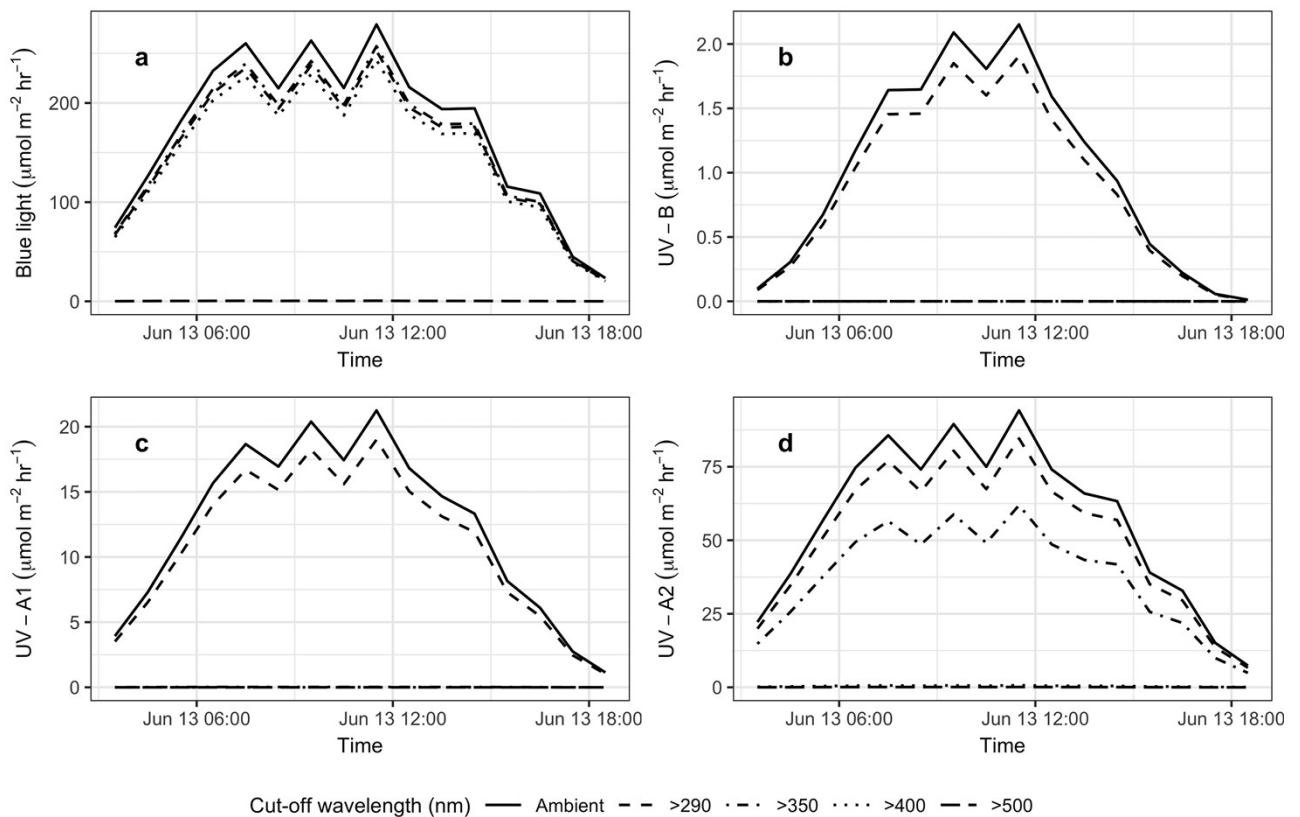
Supplementary figure 1. The photon ratio between the estimated yearly maximum spectral irradiances of sunlight in the Andean region of Ecuador and in southern Sweden at solar noon under clear sky conditions, calculated with Quick TUV Calculator (see Methods for details).



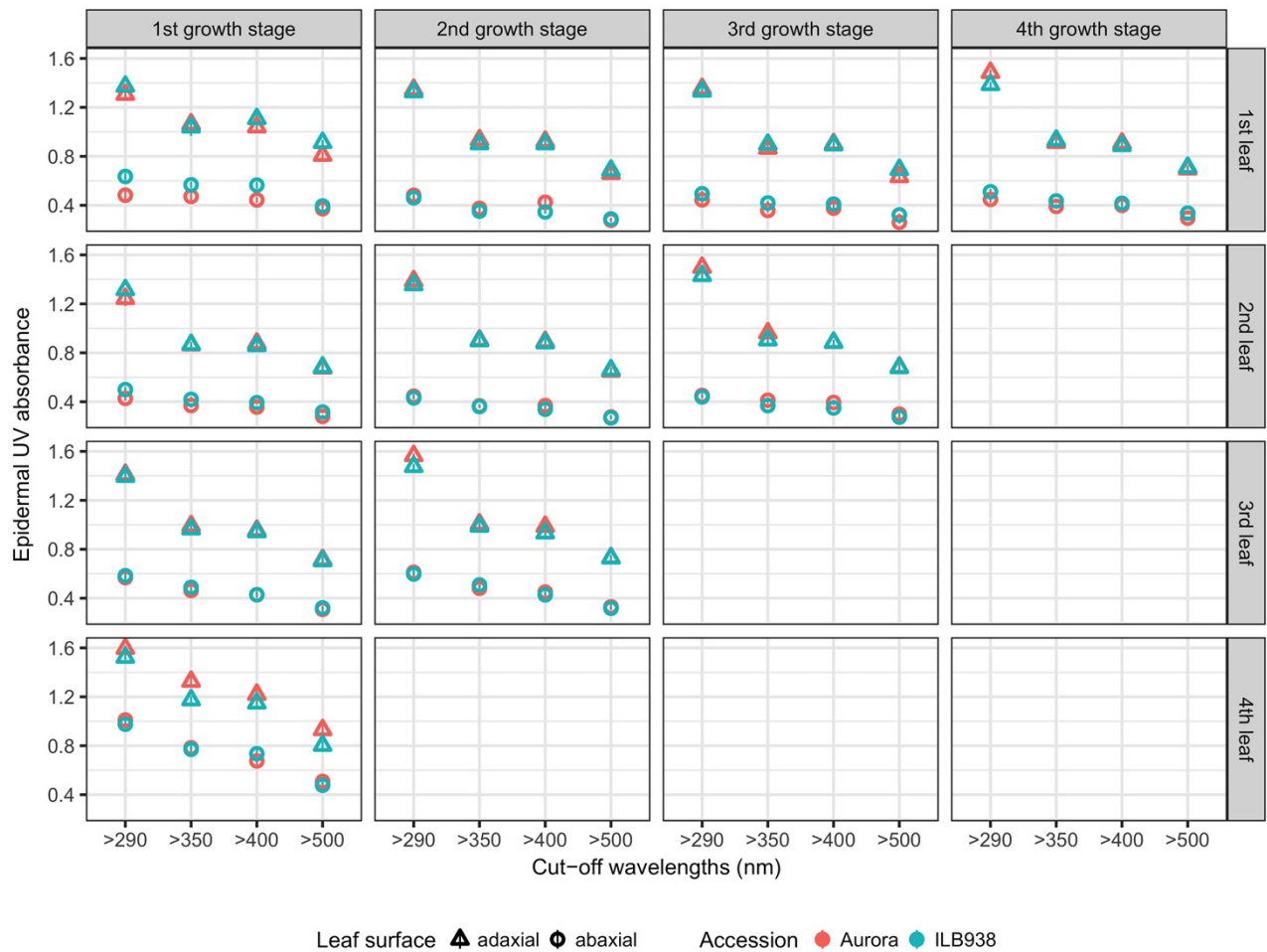
Supplementary figure 2. Photosynthetically active radiation (PAR) daily photon exposure throughout the experiment. “Ambient” is unfiltered sunlight, included here for comparison to the filter treatments used. Calculated as described in Methods.



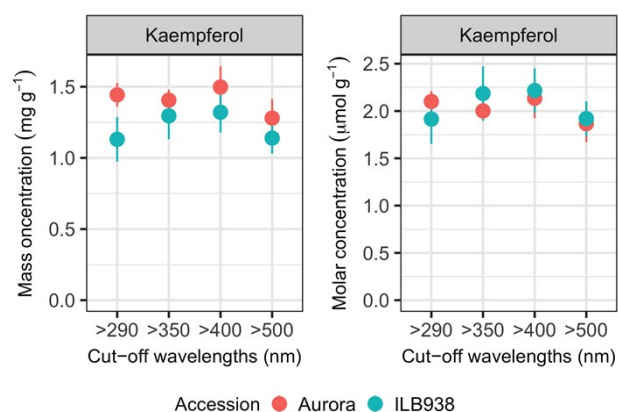
Supplementary figure 3. Photosynthetically active radiation (PAR) mean hourly photon irradiance during the last day of the experiment, when leaves were sampled for metabolite and gene transcript measurements. “Ambient” is unfiltered sunlight, included here for comparison to the filter treatments used. Calculated as described in Methods.



Supplementary figure 4. Mean hourly photon irradiance for selected regions of the solar spectrum during the last day of the experiment, when leaves were sampled for metabolite and gene transcript measurements. a. Blue light (400–500 nm); b. UV-B (290–315 nm); c. UV-A1 (315–340 nm); d. UV-A2 (340–400 nm). “Ambient” is unfiltered sunlight, included here for comparison to the filter treatments used. Calculated as described in Methods.



Supplementary figure 5. Absorbance of epidermal flavonoids per unit area in plants of accessions Aurora and ILB938 of *V. faba* grown in sunlight under four filters, assessed with Dualex on four dates (14 d, 19 d, 24 d and 29 d after plant emergence). At each date, the youngest fully expanded leaf was measured for the first time, and all leaves measured on previous dates were measured again. Stage 1 = full expansion, Stage 2 = full expansion + 5 d, Stage 3 = full expansion + 10 d, and Stage 4 = full expansion + 15 d. Means (\pm SE) of replicate blocks, 163 measured plants in total. Labels at the top of the panel columns indicate different leaf growth stage. The youngest expanded leaves measured for the first time on the last date were harvested on the next day for phenolic analysis by HPLC.



Supplementary figure 6. Comparison of total kaempferol mass concentration and molar concentration in plants of accessions Aurora and ILB938 of *V. faba* grown in sunlight under four filters. All values are means \pm SE of four replicate blocks, 163 sampled plants in total.

Supplementary table 1. Estimated yearly maximum UV-B, UV-A and PAR irradiance, UVA:PAR, UVB:PAR ratio and biologically effective UV irradiances calculated with five BSWFs for the Andean region of Ecuador and for southern Sweden where accessions ILB938 and Aurora of *V.faba* originated.

Location	UVB ($\mu\text{mol m}^{-2}\text{s}^{-1}$)	UVA ($\mu\text{mol m}^{-2}\text{s}^{-1}$)	PAR ($\mu\text{mol m}^{-2}\text{s}^{-1}$)	UVB:PAR
Ecuadorian Andes	7.6	208	2270	0.33%
Southern Sweden	3.5	150	1800	0.20%

Location	UVA:PAR	GEN(G) ($\text{W m}^{-2}\text{s}^{-1}$)	FLAV ($\text{W m}^{-2}\text{s}^{-1}$)	DNA(P) ($\text{W m}^{-2}\text{s}^{-1}$)
Ecuadorian Andes	9.2%	0.75	1.3	2.0
Southern Sweden	8.4%	0.25	0.6	1.1

Estimated UVB, UVA and PAR radiation, UVA:PAR, UVB:PAR ratio and biologically effective UV doses for Ecuador and Southern Sweden using BSWFs (biological spectral weighting functions). GEN(G) is the generalized plant action spectrum of Caldwell 1971 with Green's formulation. FLAV is the action spectrum for the accumulation of the flavonoid mesembryanthin in *Mesembryanthemum crystallinum*. DNA(P) is the action spectrum for DNA damage in alfalfa (*Medicago sativa*) seedlings. All spectra were normalized at 300 nm.

Supplementary table 2. Genes chosen for q-PCR analysis, primers designed to quantify these genes, and a brief description of gene function.

Primers	Sequence (5' \rightarrow 3')	Gene name	Description of gene function
HY5 for HY5 rev	GAGGGAGAGGAAAAAGGCATA GCTCGCAGTTGTGTTCTTCA	elongated hypocotyl5	Encodes basic leucine zipper (bZIP) transcription factor, involved in light-regulated transcriptional activation.
CHS for CHS rev	CAGAGGCTGAGTCTGCAGTT GCCAGACTCTGTTTTGCTGC	chalcone synthase	Encodes chalcone synthase, a key enzyme in biosynthesis pathway of flavonoids
CHI for CHI rev	CCGTTCCACCAGCAAACAG GCCAGACTCTGTTTTGCTGC	chalcone isomerase	Encodes chalcone isomerase, which catalyzes the conversion of chalcone to flavanones

DOGT1 for DOGT1 rev	GGTTGGGCTCCTCAGTTGTT GGCCATGTAACCATTGGCAC	don-glucosyltransferase 1	Encodes a DON-Glucosyltransferase, having quercetin glucosyltransferase activity
ABI2 for ABI2 rev	AGAGGACTGACAGTGAAATCGAA GTTTGAGTCCTGCGGCAAAG	aba insensitive 2	Encodes a protein phosphatase 2C that negatively regulates the abscisic acid-activated signalling pathway
IAA5 for IAA5 rev	AGGATGGTGATTGGATGCTC TTCCATAGCTCGAGGTGCT	auxin-inducible 2-27	Encodes a transcription factor involved in the auxin-activated signaling pathway
TAT3 for TAT3 rev	CAGCAAAAATGCTTGAACA CTCCCATAGGCACAAAAGGA	tyrosine aminotransferase 3	Encodes a tyrosine aminotransferase that responds to jasmonic acid and wounding
Reference genes			
CYP2 for CYP2 rev	TGCCGATGTCCTCCAGAA CAGCGAAGTTGGAACCGTAGA	cyclophilin 20-3	
ELF1A for ELF1A rev	GTGAAGCCCGGTATGCTTGT CTTGAGATCCTTGACTGCAACATT	eukaryotic elongation factor 1-alpha	

Supplementary table 3. Flavonoid and phenolic acid compounds identified by HPLC-MSⁿ in the leaves of accessions Aurora and ILB938 of *V. faba*, retention times (RT), molecular masses (M+1).

Compound name	RT (min)	M+1 (g mol ⁻¹)
Kaempferol-3-O-rhamnoside	26.46	432.386
Kaempferol-3-O-arabinoside-7-O-rhamnoside	16.14	564.616
Kaempferol-3-O-rhamnoside-7-O-rhamnoside	19.63	578.543
Kaempferol-3-O-galactoside-7-O-rhamnoside	13.71	594.542
Kaempferol-3-O-rhamnoglucoside	19.05	594.542
Kaempferol-3-O-acetyl-galactoside-7-O-rhamnoside	20.29	636.592
Kaempferol-3-O-rhamnoarabinoside-7-O-rhamnoside	14.38	710.773
Kaempferol-3-O-rhamnogalactoside-7-O-rhamnoside	10.2	740.699
Kaempferol-3-O-rhamnoglucoside-7-O-rhamnoside	10.7	740.699
Kaempferol-3-O-acetyl-rhamnogalactoside-7-O-rhamnoside	16.46	782.761
Kaempferol-3-O-rhamnoglucoside-7-O-rhamnoside-4' -rhamnoside	9.65	886.855
Quercetin-3-O-rhamnoside-7-O-rhamnoside	15.55	594.549
Quercetin-3-O-rhamnoside-7-O-galactoside	12.03	610.549
Quercetin-3-O-rhamnoglucoside	19.05	610.549
Quercetin-3-O-acetyl-galactoside-7-O-rhamnoside	17.6	652.598
Quercetin-3-O-rhamnoarabinoside-7-O-rhamnoside	13.07	726.779
Quercetin-3-O-rhamnogalactoside-7-O-rhamnoside	8.85	756.705
Quercetin-3-O-rhamnoglucoside-7-O-rhamnoside	9.21	756.705
Quercetin-3-O-rhamnorhamnogalactoside	11.21	756.705
Caffeoyl-glucoside	5.53	342.300

Feruloyl-glucoside	7.51	386.353
Sinapoyl-glucoside	7.11	356.327
Unknown1	6.49	595
Unknown2	6.77	595
