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Supporting information for

Ozone Response of Leaf Physiological and Stomatal Characteristics in *Brassica juncea* L. at Supraoptimal Temperatures

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Table S1. Formulas and descriptions of OJIP parameters based on data obtained from OJIP transient curves (based on information from [1, 2]).

Fluorescence parameter	Description
Fluorescence parameters derived from the OJIP transient	
$F_O = F_{50\mu s}$	Minimum fluorescence intensity (50 μs) at O-step
$F_J = F_{2ms}$	Fluorescence intensity (2 ms) at J-step
$F_I = F_{30ms}$	Fluorescence intensity (30 ms) at I-step
$F_P = F_m$	Maximum fluorescence intensity at P-step
$F_v = F_m - F_O$	Maximum variable fluorescence
$M_O = 4(F_{300\mu s} - F_O)/(F_m - F_O)$	Approximated initial slope (in ms^{-1}) of the fluorescence transient
$V_J = (F_{2ms} - F_O)/(F_m - F_O)$	Relative variable fluorescence at 2 ms
Flux ratios or yields	
$\varphi P_O = TR_O/ABS = 1-(F_O/F_M) = F_v/F_m$	Maximum quantum yield of primary PS II photochemistry
$\varphi E_O = \varphi P_O \times (1-V_J)$	Quantum yield of the electron transport at t = 0
$\varphi D_O = 1 - \varphi P_O = F_O/F_M$	Quantum yield (at t = o) for energy dissipation
$\psi_O = ET_O/TR_O = 1 - V_J$	Probability (at time 0) that a trapped exciton moves an electron into the electron transport chain beyond primary quinone electron acceptor in photosystem II (Q_A)
Specific energy fluxes per reaction center (RC)	
$ABS/RC = M_O \times (1/V_J) \times (1/\varphi P_O)$	Absorption flux per RC
$TR_O/RC = M_O/V_J$	Trapped energy flux per RC at t = 0
$ET_O/RC = M_O \times (1/V_J) \times (\varphi E_O)$	Electron transport flux per RC at t = 0
$DI_O/RC = (ABS/RC) - (TR_O/RC)$	Dissipated energy flux per RC at t = 0
Phenomenological energy fluxes or phenomenological activities per excited cross section (CS)	
$ABS/CS = F_O$	Absorption flux per CS at t = 0
$TR_O/CS = \varphi P_O \times (ABS/CS)$	Trapped energy flux per CS at t = 0
$ET_O/CS = \varphi P_O \times \psi_O \times (ABS/CS)$	Electron transport flux per CS at t = 0
$DI_O/CS = (ABS/CS) - (TR_O/CS)$	Dissipated energy flux per CS at t = 0
$RC/CS = \varphi P_O \times (V_J/M_O) \times (ABS/CS)$	Q_A reducing PS II reaction centers per CS
Performance index	
$PI_{ABS} = (RC/ABS) \times \varphi P_O/(1- \varphi P_O) \times \psi_O/(1-\psi_O)$	Performance index (PI) on absorption basis

Table S2. Results of analyses of variance of the main effects of temperature, O_3, and sampling date and their interactions on A/C_i curve response, chlorophyll content, chlorophyll *a* fluorescence, stomatal density, stomatal pore area, hydrogen peroxide and superoxide radical accumulation, and leaf growth parameters. Data were analyzed using three-way or two-way ANOVAs.

Parameters	Temp.	O_3	Temp. × O_3	Date	Temp. × Date	O_3 × Date	Temp. × O_3 × Date
Rubisco carboxylation	**<0.01**	**<0.001**	0.223	0.164	**<0.01**	**<0.001**	0.086
Electron transport	0.098	**<0.001**	**<0.01**	**<0.001**	**<0.01**	**<0.001**	0.34
Triose phosphate use	0.271	**<0.001**	**<0.001**	**<0.001**	**<0.01**	**<0.001**	0.271
Day respiration	**<0.001**	0.491	0.571	0.166	0.64	**<0.01**	0.304
Mesophyll conductance	0.138	**<0.001**	0.843	**<0.001**	0.661	0.287	0.724
Total chlorophyll	**<0.01**	**<0.001**	0.155	0.152	0.126	**<0.05**	0.634
Chlorophyll a/b ratio	0.090	0.105	0.602	0.707	**<0.05**	0.057	0.319
J step in Chl *a* fluorescence	**<0.001**	**<0.001**	**<0.05**	0.252	0.609	**<0.05**	0.22
I step in Chl *a* fluorescence	0.331	**<0.001**	0.118	0.069	0.372	**<0.05**	0.511
P step in Chl *a* fluorescence	0.286	**<0.001**	0.275	0.547	0.741	**<0.01**	0.952
Stomatal density	**<0.01**	**<0.001**	**<0.01**				
Stomatal pore area	0.107	**<0.001**	0.674				
DAB	**<0.05**	**<0.001**	0.746				
NBT	**<0.001**	**<0.001**	**<0.001**				
Leaf fresh weight	**<0.001**	**<0.001**	**<0.05**				
Leaf dry weight	**<0.001**	**<0.001**	**<0.001**				

Number of leaves	1.000	**<0.01**	0.084
Leaf area	**<0.001**	**<0.001**	0.054

Table S3. Comparison of each parameter under different ambient and supraoptimal temperatures and O_3 concentrations at 7 and 14 days after exposure (DAE). Data are summarized as means ± SD (n = 5) and were analyzed using the independence t-test. Statistical significance: *, $p \leq 0.05$; **, $p \leq 0.01$; ***, $p \leq 0.001$. C: optimal temperatures and ambient O_3; T: supraoptimal temperature and ambient O_3; O: supraoptimal temperatures and elevated O_3; OT: supraoptimal temperature and elevated O_3; DAE: Days after exposure.

Parameters	C		T		O		OT	
	7 DAE	14 DAE	7 DAE	14 DAE	7 DAE	14 DAE	7 DAE	14 DAE
Rubisco carboxylation (μ mol m^{-2} s^{-1})	164 ± 12.69	162 ± 11.30	132 ± 19.50	**176 ± 17.30***	131 ± 13.32	**90 ± 5.17****	104 ± 16.62	**74 ± 21.89***
Electron transport (μ mol m^{-2} s^{-1})	207 ± 13.52	**186 ± 8.36****	189 ± 17.87	**221 ± 22.53***	197 ± 16.05	**125 ± 10.34*****	153 ± 25.19	**110 ± 28.01***
Triose phosphate use (μ mol m^{-2} s^{-1})	13.16 ± 0.77	**11.40 ± 0.30****	12.46 ± 1.14	**14.40 ± 1.29***	13.80 ± 0.49	**8.66 ± 0.88*****	10.80 ± 1.68	**7.64 ± 2.07***
Day respiration (μ mol m^{-2} s^{-1})	3.83 ± 1.28	4.28 ± 0.73	6.64 ± 1.09	7.75 ± 2.31	4.09 ± 1.47	**2.56 ± 0.63***	8.76 ± 3.07	5.49 ± 2.39
Mesophyll conductance (μ mol m^{-2} s^{-1} Pa^{-1})	5.29 ± 1.57	3.44 ± 1.07	4.86 ± 1.50	3.06 ± 0.34	3.20 ± 0.89	1.80 ± 0.30	2.43 ± 0.63	**1.54 ± 0.44***
Total chlorophyll (mg g^{-1} FW)	7.67 ± 0.55	8.21 ± 0.37	7.05 ± 0.21	6.76 ± 0.41	6.45 ± 0.73	5.95 ± 0.74	6.23 ± 0.96	5.29 ± 0.79
Chlorophyll a/b ratio	3.36 ± 0.10	3.41 ± 0.42	3.16 ± 0.09	3.04 ± 0.05	3.17 ± 0.15	2.98 ± 0.12	2.70 ± 0.19	2.82 ± 0.35
J step in Chl *a* fluorescence	2.41 ± 0.07	2.52 ± 0.04	2.30 ± 0.05	**2.46 ± 0.10***	2.36 ± 0.10	2.37 ± 0.12	2.15 ± 0.03	2.03 ± 0.23
I step in Chl *a* fluorescence	3.76 ± 0.15	**4.15 ± 0.07****	3.84 ± 0.29	**4.18 ± 0.13***	3.48 ± 0.28	3.61 ± 0.37	3.39 ± 0.28	3.22 ± 0.53
P step in Chl *a* fluorescence	5.57 ± 0.14	**5.82 ± 0.18***	5.51 ± 0.37	5.89 ± 0.04	5.20 ± 0.31	4.66 ± 0.60	4.84 ± 0.67	4.38 ± 0.78

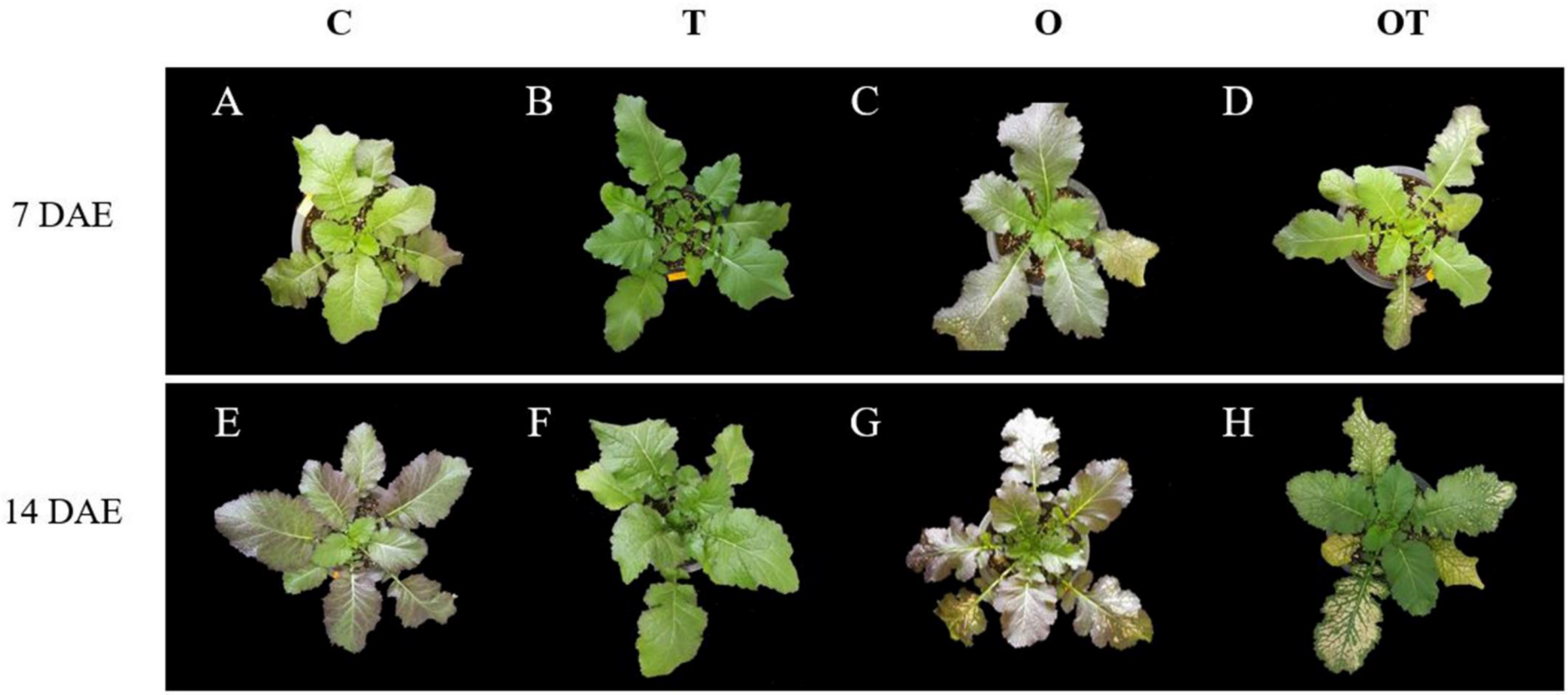

Figure S1. Visible ozone symptoms of Brassica juncea L. under different optimal and supraoptimal temperatures and O3 concentration at 7 and 14 DAE. C: optimal temperatures and ambient O3; T: supraoptimal temperature and ambient O3; O: supraoptimal temperatures and elevated O3; OT: supraoptimal temperature and elevated O3; DAE: Days after the beginning of exposure.

Supporting information references

1. Sharkey, T.D.; Bernacchi, C.J.; Farquhar, G.D.; Singaas, E.L. Fitting photosynthetic carbon dioxide response curves for C_3 leaves. *Plant. Cell Environ.* **2007**, *30*, 1035–1040, doi:10.1111/j.1365-3040.2007.01710.x.
2. Strasser, R.J.; Tsimilli-Michael, M.; Srivastava, A. Analysis of the Chlorophyll *a* Fluorescence Transient. In; Springer, Dordrecht: Dordrecht, Netherlands, 2004; pp. 321–362.