SUPPLEMENTARY MATERIAL

Photosynthetic efficiency and gene expression responses of maize (*Zea mays* L.) seedlings to diverse abiotic stresses

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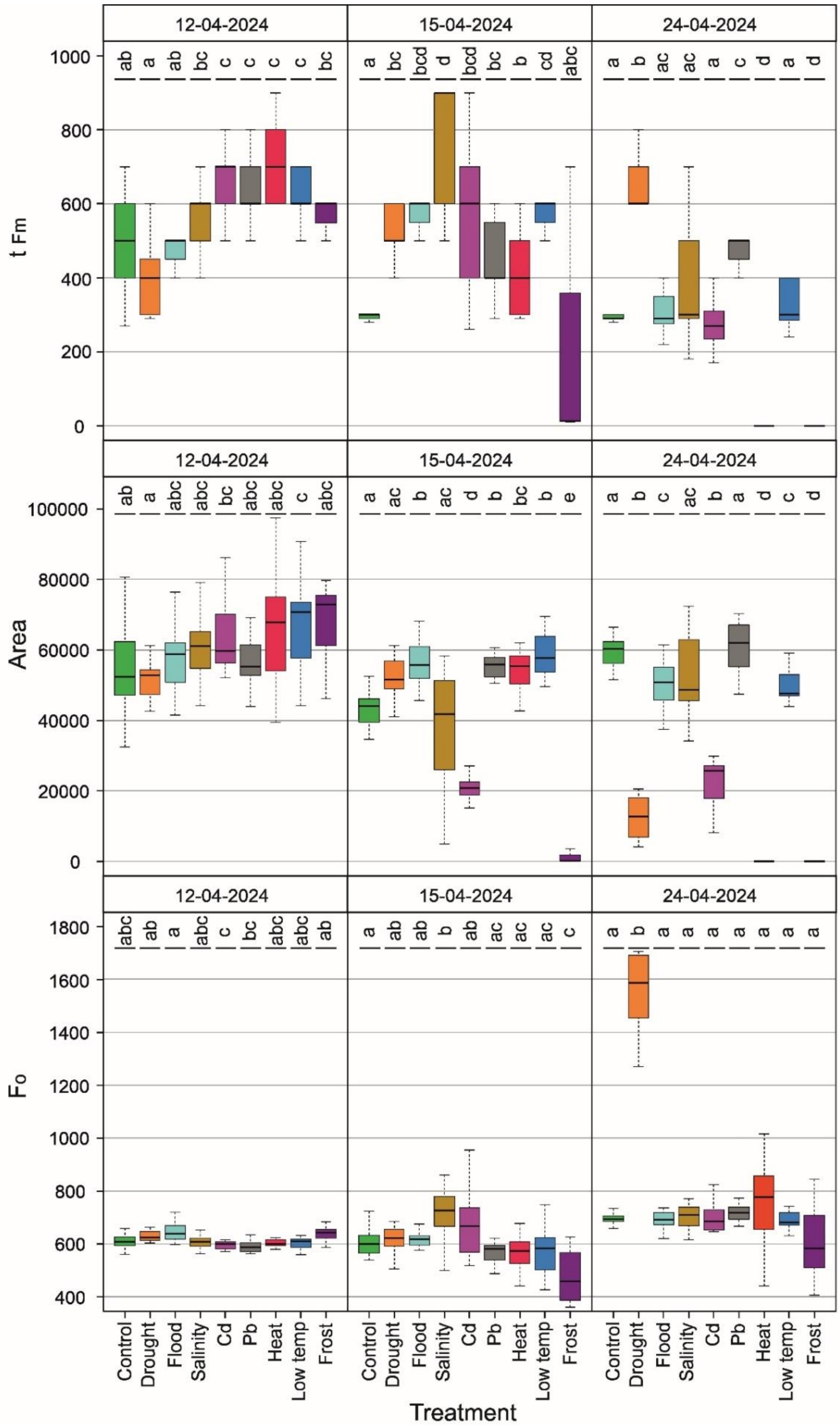
Table S1. Glossary, definition of terms, and formulae used by the JIP-test for the analysis of the Chl *a* fluorescence transient OJIP emitted by dark-adapted photosynthetic samples

t_{FM}	time (in ms) to reach the maximal fluorescence F_p (meaningful only when $F_p = F_M$)
Area	total complementary area between the fluorescence induction curve and $F = F_p$ (meaningful only when $F_p = F_m$)
$F_0 \cong F_{50\mu s}$ or $\cong F_{20\mu s}$	fluorescence when all PSII RCs are open ($\cong$ to the minimal reliable recorded fluorescence)
F_M (= F_p)	maximal fluorescence, when all PSII RCs are closed (= F_P when the actinic light intensity is above 500 μmol(photon)$\cdot m^{-2} \cdot s^{1}$ and provided that all RCs are active as Q_A-reducing)
$F_V \equiv F_M - F_0$	maximal variable fluorescence at time t
F_V/F_M	maximum quantum yield for primary photochemistry
$ABS/RC = M_0 \cdot (1/V_J) \cdot (1/\phi_{Po})$	absorption flux (exciting PSII antenna Chl *a* molecules) per RC (also used as a unit-less measure of PSII apparent antenna size)
$TR_0/RC = M_0 \cdot (1/V_J)$	trapped energy flux (leading to Q_A reduction), per RC
$RE_0/RC = M_0 \cdot (1/V_J) \cdot (1 - V_I)$	electron flux reducing end electron acceptors at the PSI acceptor side, per RC
$ET_0/RC = M_0 \cdot (1/V_J) \cdot (1 - V_J)$	electron transport flux (further than Q_A^-), per RC
$DI_0/RC = (ABS/RC) - (TR_0/RC)$	energy flux not intercepted by an RC, dissipated in the form of heat, fluorescence, or transfer to other systems, at time t = 0
$\Phi_{Po} \equiv TR_0/ABS = [1 - (F_0/F_M)]$	maximum quantum yield for primary photochemistry at any time t
$\Phi_{Eo} \equiv ET_0/ABS = [1 - (F_0/F_M)] \cdot (1 - V_J)$	quantum yield for electron transport (ET)
$\Phi_{Ro} \equiv RE_0/ABS = [1 - (F_0/F_M)] \cdot (1 - V_I)$	quantum yield for reduction of end electron acceptors at the PSI acceptor side (RE)
$\psi_{Eo} \equiv ET_0/TR_0 = (1 - V_J)$	efficiency/probability that an electron moves further than Q_A^-
$\Delta_{Ro} \equiv RE_0/ET_0 = (1 - V_I)/(1 - V_J)$	efficiency/probability with which an electron from the intersystem electron carriers is transferred to reduce end electron acceptors at the PSI acceptor side (RE)
$N = S_m \cdot (M_0/V_J)$	turnover number (expresses how many times Q_A is reduced in the time interval from 0 to t_{FM})
$S_m = (Area)/(F_M - F_0)$	normalised total area above the OJIP curve
PI_{ABS}	performance index for energy conservation from photons absorbed by PSII until the reduction of intersystem electron acceptors
PI_{total}	total performance index for energy conservation from photons absorbed by PSII until the reduction of PSI end electron acceptors
$DF_{ABS\,=}\ \log(PI_{ABS})$	driving force (potential) for energy conservation from photons absorbed by PSII until the reduction of intersystem electron acceptors
$DF_{total} = \log(PI_{total})$	driving force (potential) for energy conservation from photons absorbed by PSII until the reduction of PSI end electron acceptors

Explanations: RC = reaction centre, PSII = photosystem II, PSI = photosystem I.
Source: Tsimilli-Michael (2020), modified.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15-04-2024
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t Fm
Area
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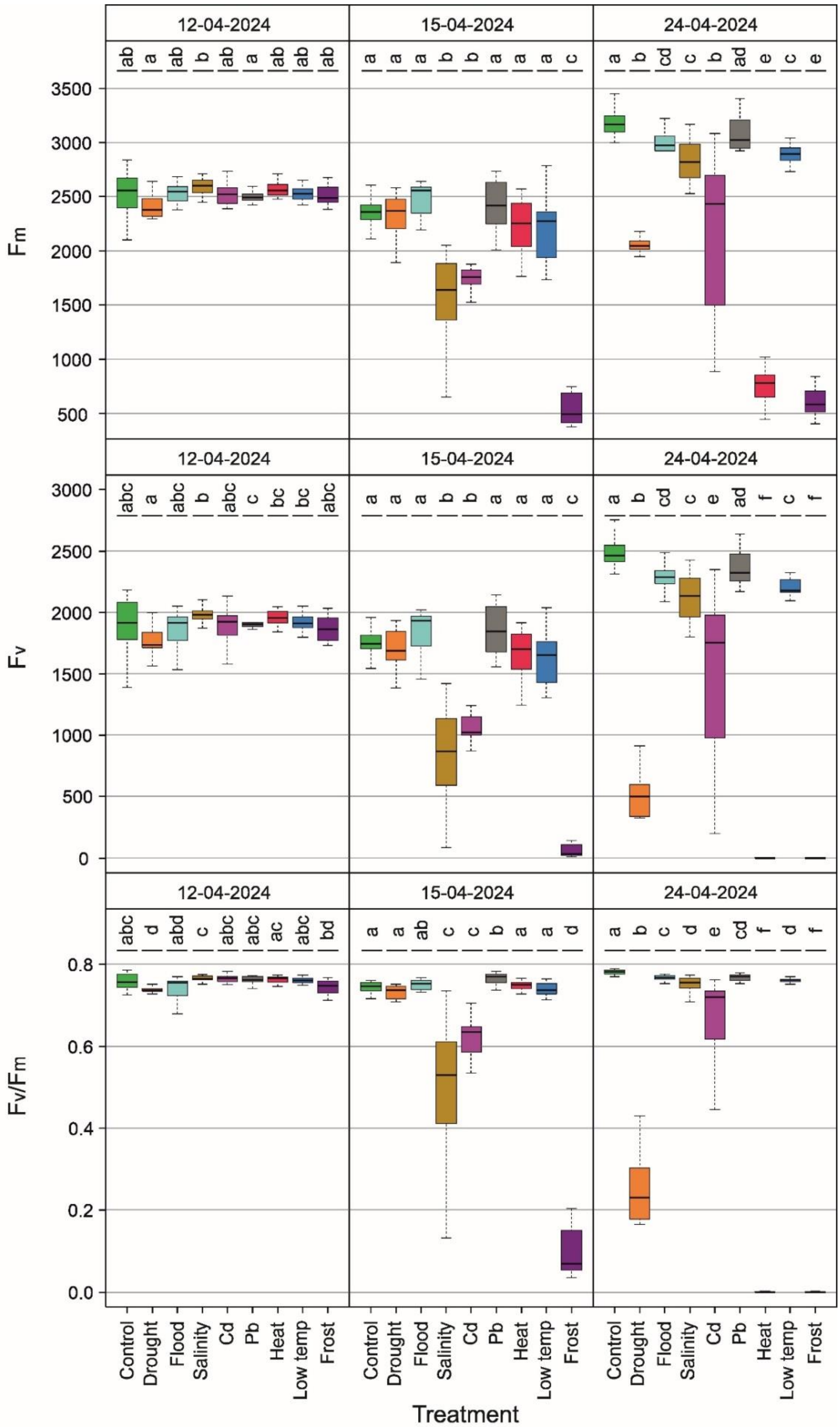
Control
Drought
Flood
Salinity
Cd
Pb
Heat
Low temp
Frost
Treatment



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15-04-2024
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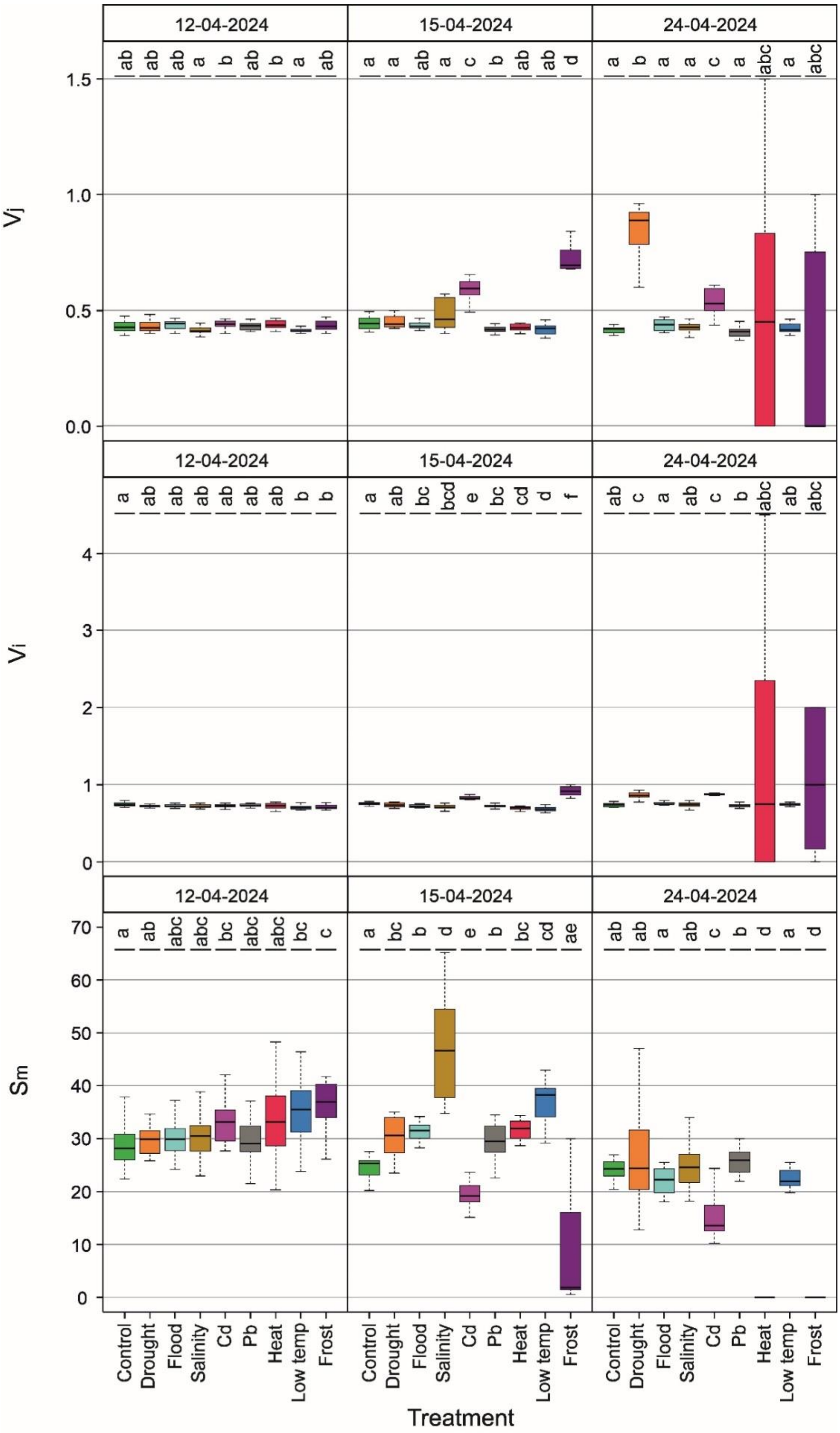
Fm
Fv
Fv/Fm
Control
Drought
Flood
Salinity
Cd
Pb
Heat
Low temp
Frost
Treatment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1.5
1.0
0.5
0.0
12-04-2024
15-04-2024
24-04-2024
a ab ab ab ab ab ab b b
a ab bc bcd e bc cd d f
ab c a ab c b abc ab abc
Vi
4
3
2
1
0
12-04-2024
15-04-2024
24-04-2024
a ab abc abc bc abc abc bc c
a bc b d e b bc cd ae
ab ab a ab c b d a d
Sm
70
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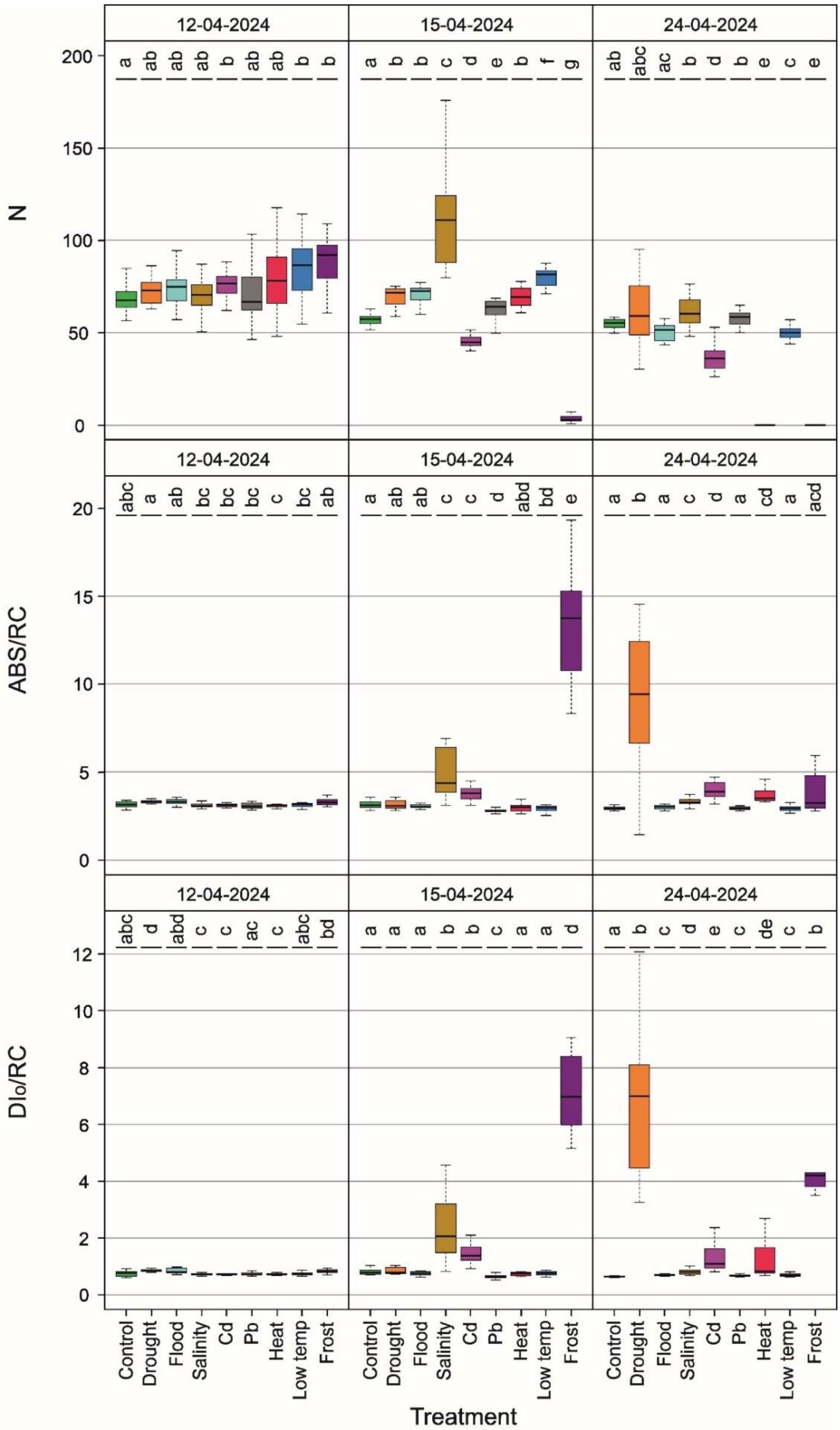
Control
Drought
Flood
Salinity
Cd
Pb
Heat
Low temp
Frost
Treatment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15-04-2024
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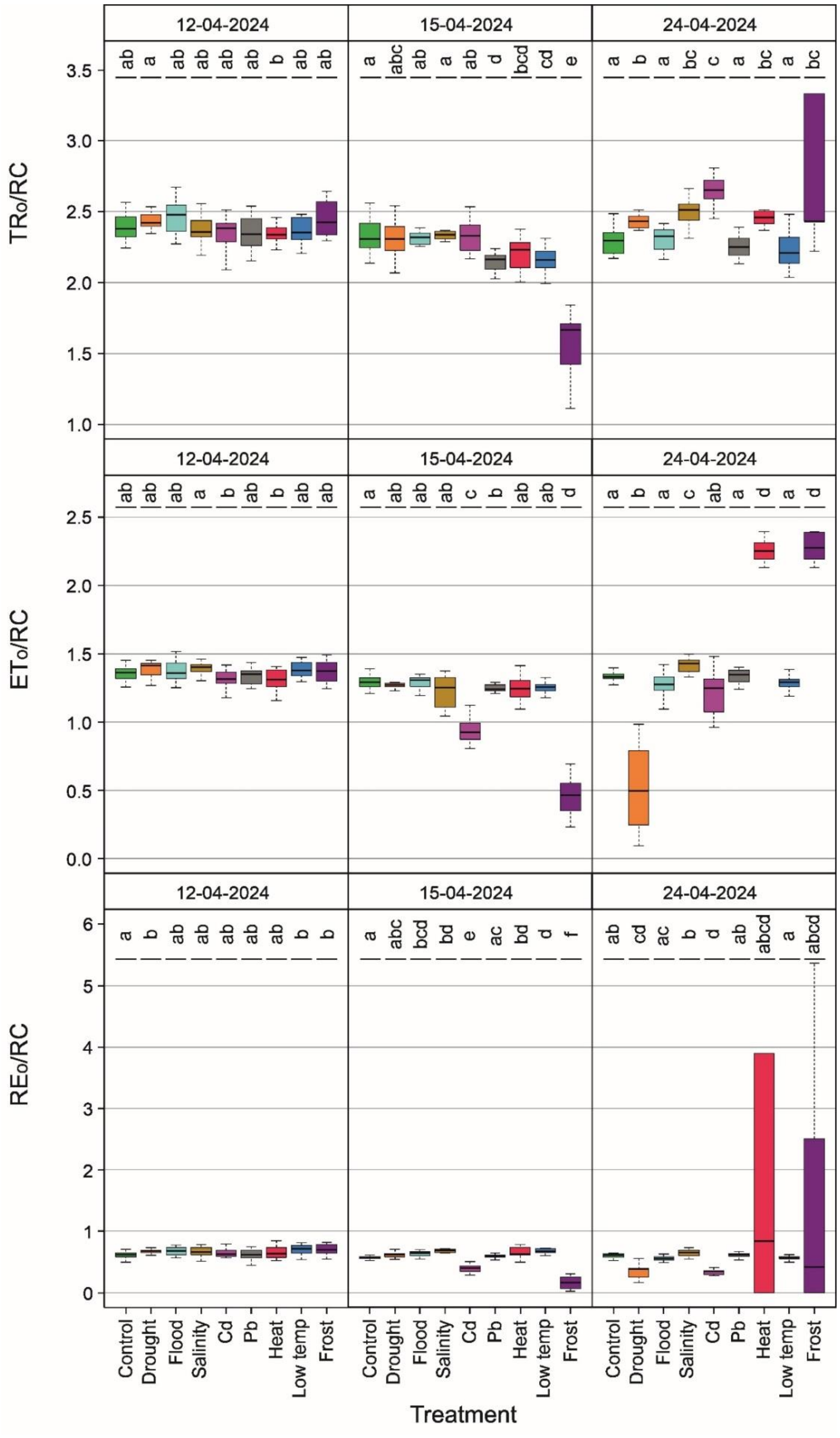
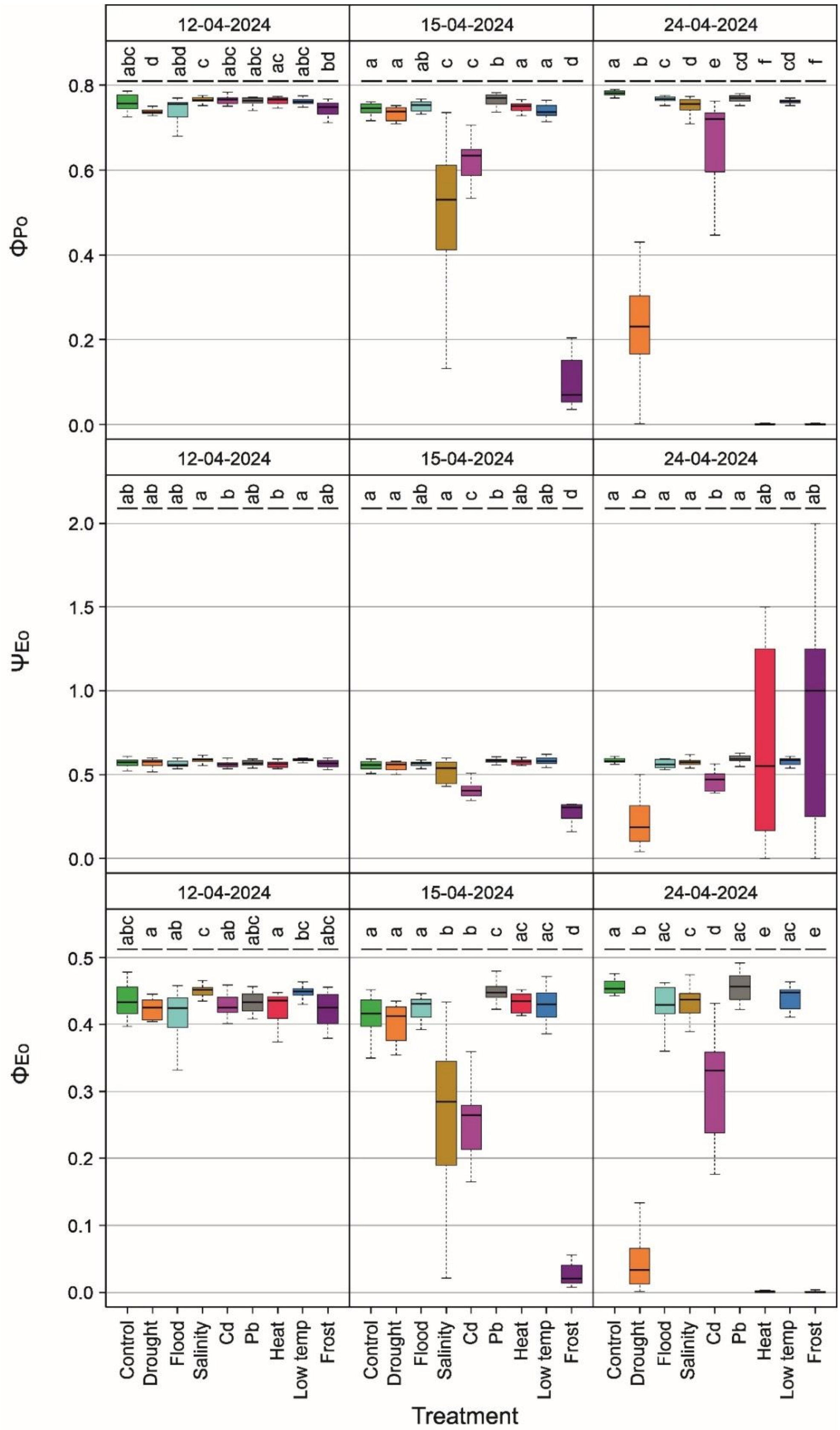
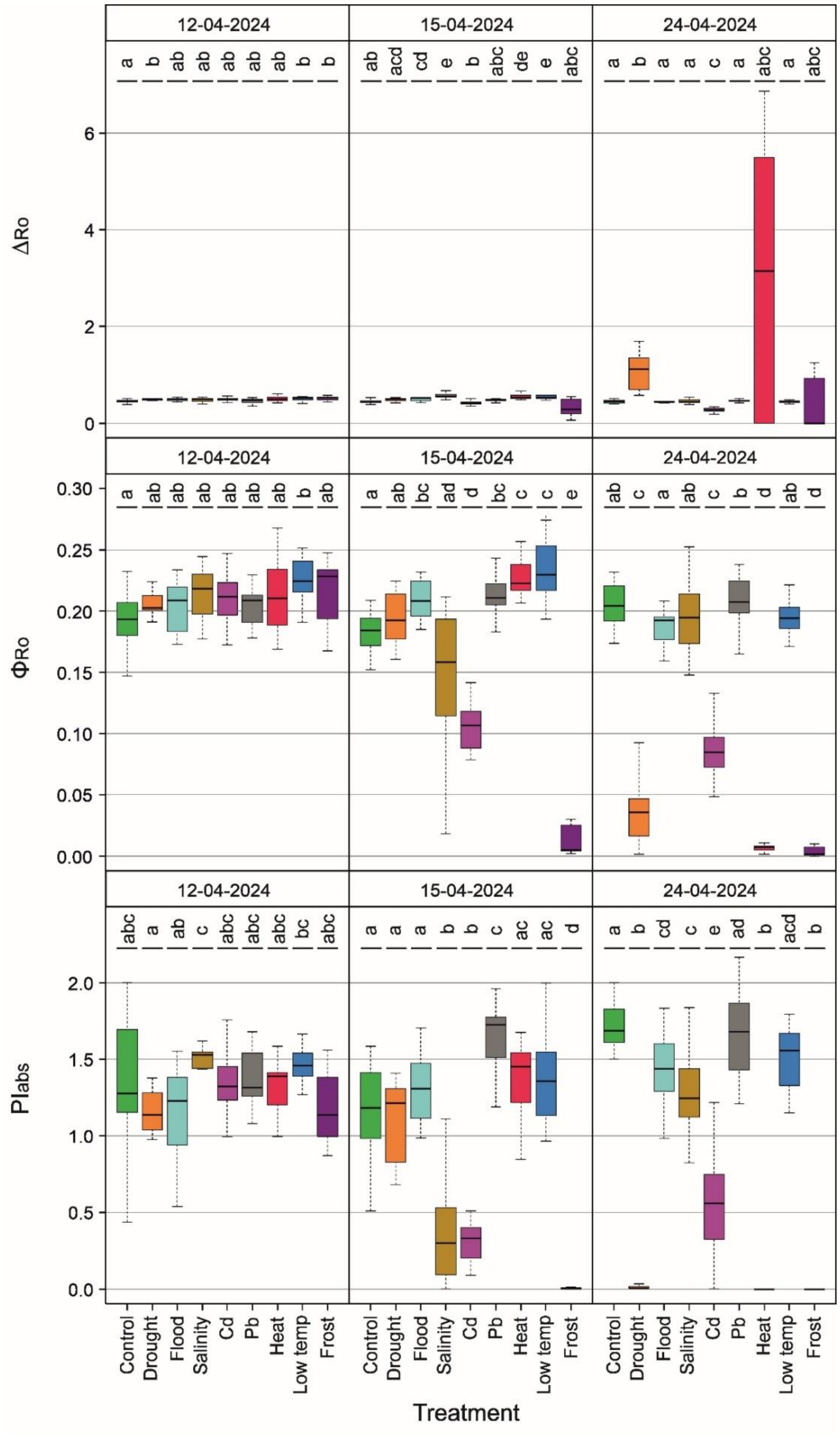
N
ABS/RC
DIo/RC
Control
Drought
Flood
Salinity
Cd
Pb
Heat
Low temp
Frost
Treatment



12-04-2024
15-04-2024
24-04-2024
TR₀/RC
ET₀/RC
RE₀/RC
Control
Drought
Flood
Salinity
Cd
Pb
Heat
Low temp
Frost
Treatment



12-04-2024
15-04-2024
24-04-2024
ΦPo
ΨEo
ΦEo
Control
Drought
Flood
Salinity
Cd
Pb
Heat
Low temp
Frost
Treatment


12-04-2024
15-04-2024
24-04-2024
ΔRo
ΦRo
PIabs
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ab acd cd e b abc de e abc
a b a a c a abc a abc
a ab ab ab ab ab ab b ab
a ab bc ad d bc c c e
ab c a ab c b d ab d
abc a ab c abc abc abc bc abc
a a a b b c ac ac d
a b cd c e ad b acd b
0
2
4
6
0.00
0.05
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0.15
0.20
0.25
0.30
0.0
0.5
1.0
1.5
2.0
Control
Drought
Flood
Salinity
Cd
Pb
Heat
Low temp
Frost
Treatment

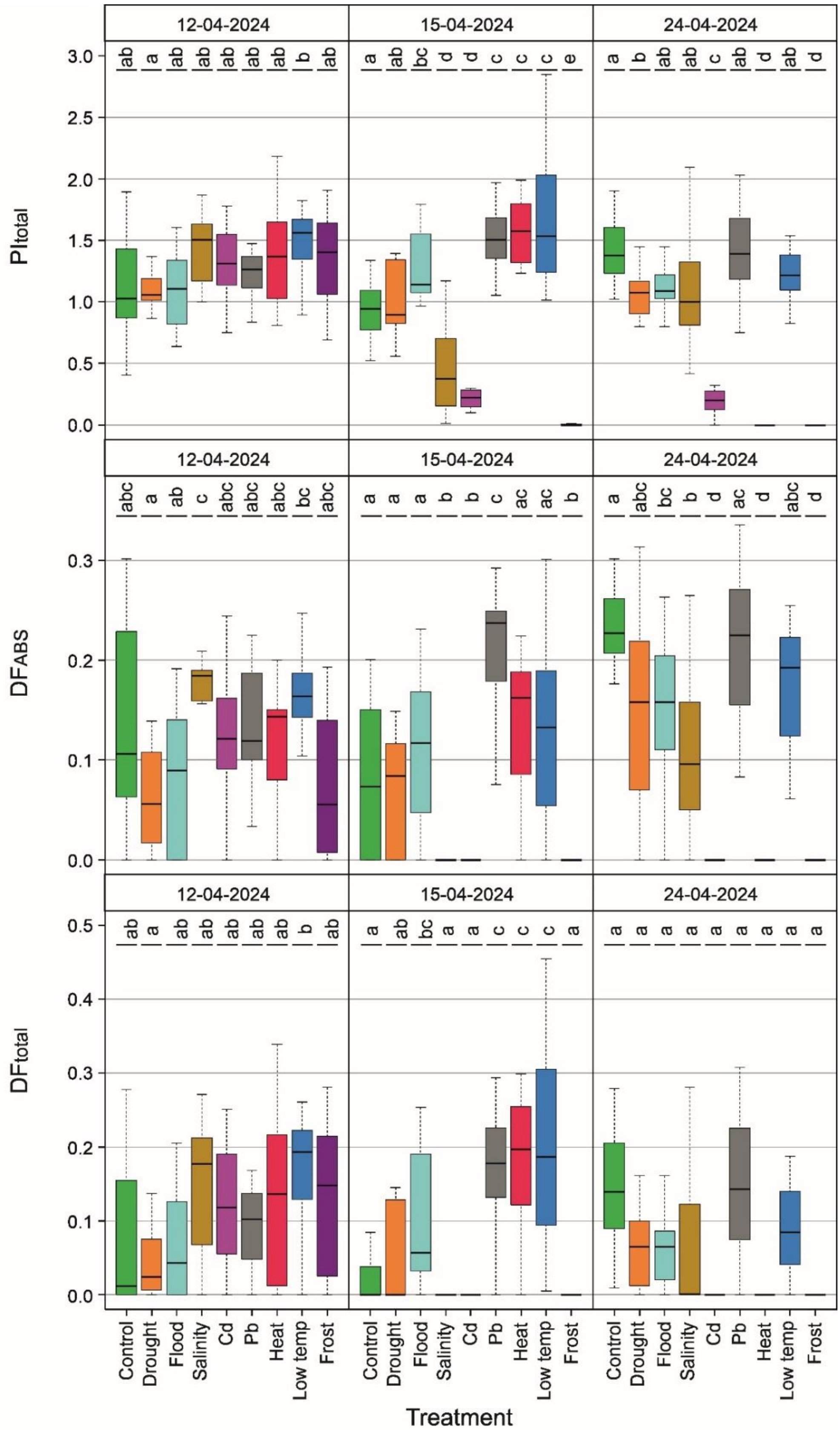

Fig. S1. Chlorophyll *a* fluorescence parameters of maize under various abiotic stress treatments: control, drought, flood, salinity, Cd, Pb, heat, low temperature, and frost; measurements were taken on three dates: April 12th, 15th and 24th, 2024; letters above the boxes indicate results of a post hoc Wilcoxon rank-sum test; treatments not sharing a letter differ significantly at the 0.05 level; horizontal lines within boxes represent medians, boxes indicate the interquartile range (IQR; 25–75%), and whiskers extend to 1.5 IQR, with data points beyond this range considered potential outliers; parameter definitions are provided on the Table S1; source: own study

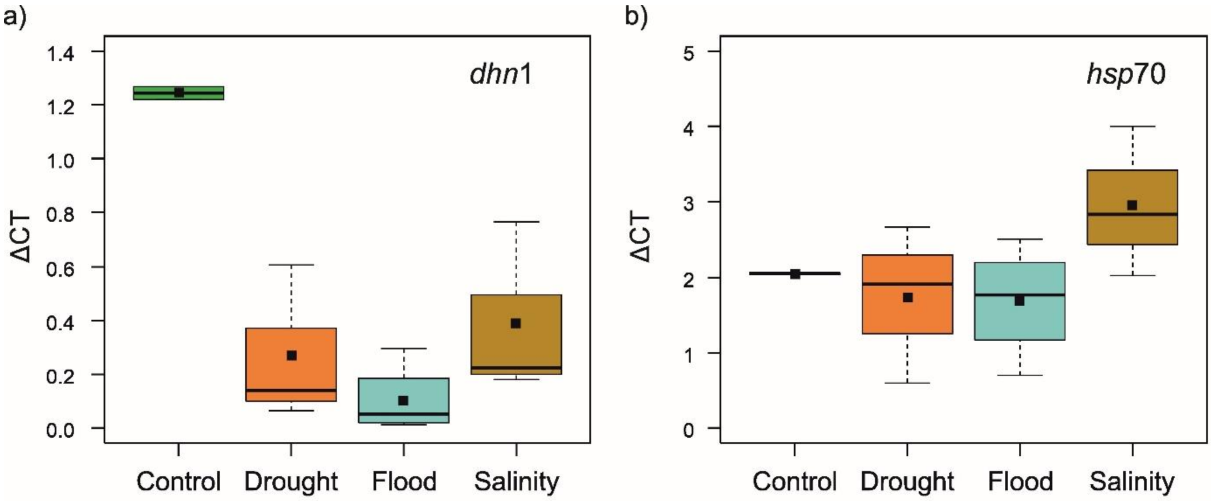

Fig. S2. Relative expression profiles of two stress-responding genes in *Zea mays* (L.) leaves exposed to drought, flood, and salinity treatments: a) *dhn*1, b) *hsp*70; horizontal lines within boxes represent medians, black squares represent mean values, boxes define interquartile range (IQR; 25–75%) and whiskers extend to IQR 1.5 range indicating possible outlier observations outside their range; source: own study