Electronic Supplementary Material (ESI) for Photochemical & Photobiological Sciences.

Supplementary Figure Legends

Fig. S1 Effect of 6 days of gamma irradiation without (UV-) or with (UV+) UV-B (0.35 W m^{-2}) in Scots pine seedlings; A) Shoot and B) root length relative to the unexposed control. Mean of 48-90 plants per treatment. C) Shoot and D) root length relative to the unexposed control in experiments including also 4 days UV-B at 0.35 W m^{-2} pre-treatment of the UV-B exposed plants. Mean of 27-51 plants per treatment. (The actual shoot and root lengths shown in Fig. 1). Relative E) shoot and F) root length and actual G) shoot (regression analysis values (R^2): UV-: 0.84; UV+: 0.20).and H) root length (R^2: UV-: 0.91; UV+: 0.05) in an experiment including 4 days UV-B pre-treatment at 0.52 W m^{-2}. Mean ± SE of 10 plants per treatment. The treatments started when plants were 6 days old. Different letters within a plant part indicate significant differences ($p \leq 0.05$) based on analysis of variance followed by Tukey`s test.

Fig. S2 Effect of 6 days of gamma irradiation without (UV-) or with (UV+) UV-B (0.35 W m^{-2}) in Scots pine seedlings; A) DNA damage (COMET assay) in shoot tips relative to the unexposed control. B) DNA damage in shoot tips relative to the unexposed control in experiments including also 4 days UV-B (0.35 W m^{-2}) pre-treatment of the UV-B exposed plants. (The actual DNA damage values shown in Fig. 2). C) Relative and D) actual DNA damage (COMET assay) (regression analysis value (R^2): 0.87) in shoot tips in an experiment including 4 days UV-B pre-treatment at 0.52 W m^{-2}. Mean of 6 (A, B) or 3 (C, D) samples per treatment with 3 technical replicates (gels) per sample with 50-100 nuclei scored per gel. The treatments started when plants were 6 days old. Different letters indicate significant differences ($p \leq 0.05$) based on analysis of variance followed by Tukey`s test.

Fig. S3 Effect of 6 days gamma irradiation with (UV+) or without (UV-) UV-B (0.35 W m^{-2}) on total antioxidant capacity (Ferric reducing antioxidant power (FRAP) assay) in A) entire Scots pine seedlings (mean ± SE of 4 samples) or B) shoots only (mean ± SE of 3 samples). Three technical replicates were

analysed per sample. The treatments started when the seedlings were 6 days old. Different letters within a diagram indicate significant differences ($p \leq 0.05$) based on analysis of variance followed by Tukey`s test.

Fig. S4 Post-irradiation effects of 6 days of gamma irradiation without (UV-) or with (UV+) UV-B (0.35 W m^{-2}) in Scots pine seedlings; A) Cumulative shoot elongation, B) shoot diameter (needle tip to needle tip) and C) number of needles relative to the unexposed control. D) Cumulative shoot elongation, E) shoot diameter and F) number of needles relative to the unexposed control in experiments including also 4 days UV-B (0.35 W m^{-2}) pre-treatment of the UV-B exposed plants. (The actual values are shown in Fig. 4). The irradiation treatments started when the seedlings were 6 days old, and time 0 corresponds to the day the irradiation treatments ended. The results are mean ± SE of 24 plants per treatment.

Fig. S5 Post-irradiation effect 44 days after 6 days of gamma irradiation without (UV-) or with (UV+) UV-B (0.35 W m^{-2}) on DNA damage (COMET assay) relative to the unexposed control in A) shoot and B) root tips of Scots pine seedlings. The irradiation treatments started when plants were 6 days old. The results are mean of 6 samples per treatment with 3 technical replicates (gels) per sample with 50-100 nuclei scored per gel.

Fig. S6 Post-irradiation effect 7 months after 6 days of gamma irradiation without (UV-) or with (UV+) UV-B (0.35 W m^{-2}) in Scots pine seedlings, including also 4 days UV-B (0.52 W m^{-2}) pre-treatment of UV-B exposed seedlings. A) Plant phenotype. DNA damage in shoot tips B) relative to the unexposed control and C) actual DNA damage values (regression analysis value R^2: 0.33). The line in each box = the mean of the median values for 3 repeated samples per treatment with 3 technical replicates (gels) per sample with 50-100 nuclei scored per gel. Lower and upper box boundaries = 25 and 75% percentiles,

error bars = 10 and 90% percentiles with data points outside these shown as dots. Different letters indicate significant differences ($p \leq 0.05$) based on analysis of variance followed by Tukey`s test.

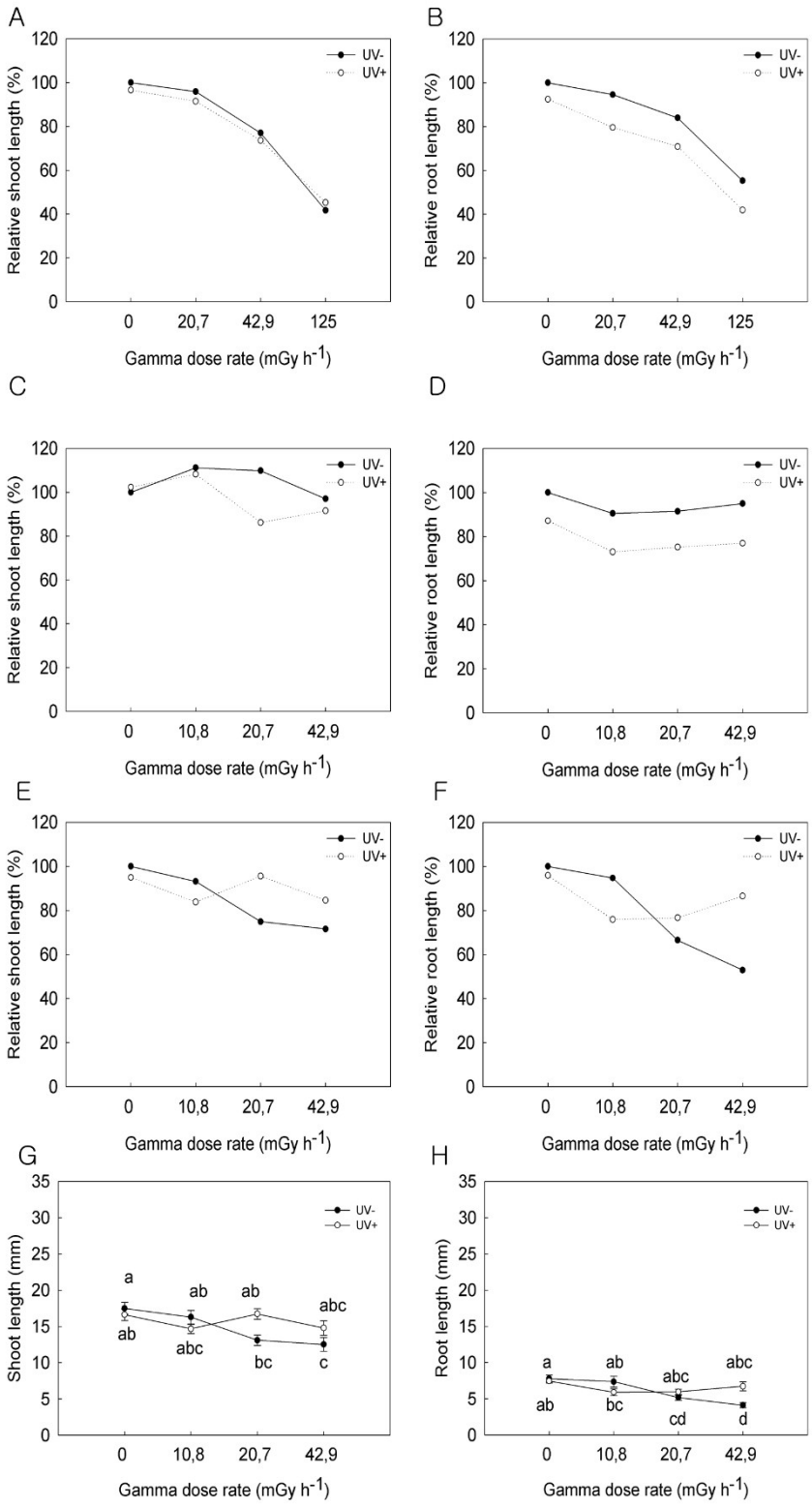
A
B
C
D
E
F
G
H
Relative shoot length (%)
Relative root length (%)
Shoot length (mm)
Root length (mm)
UV-
UV+
0
20,7
42,9
125
10,8
Gamma dose rate (mGy h-1)
a
ab
abc
bc
c
cd
d

Fig. S1

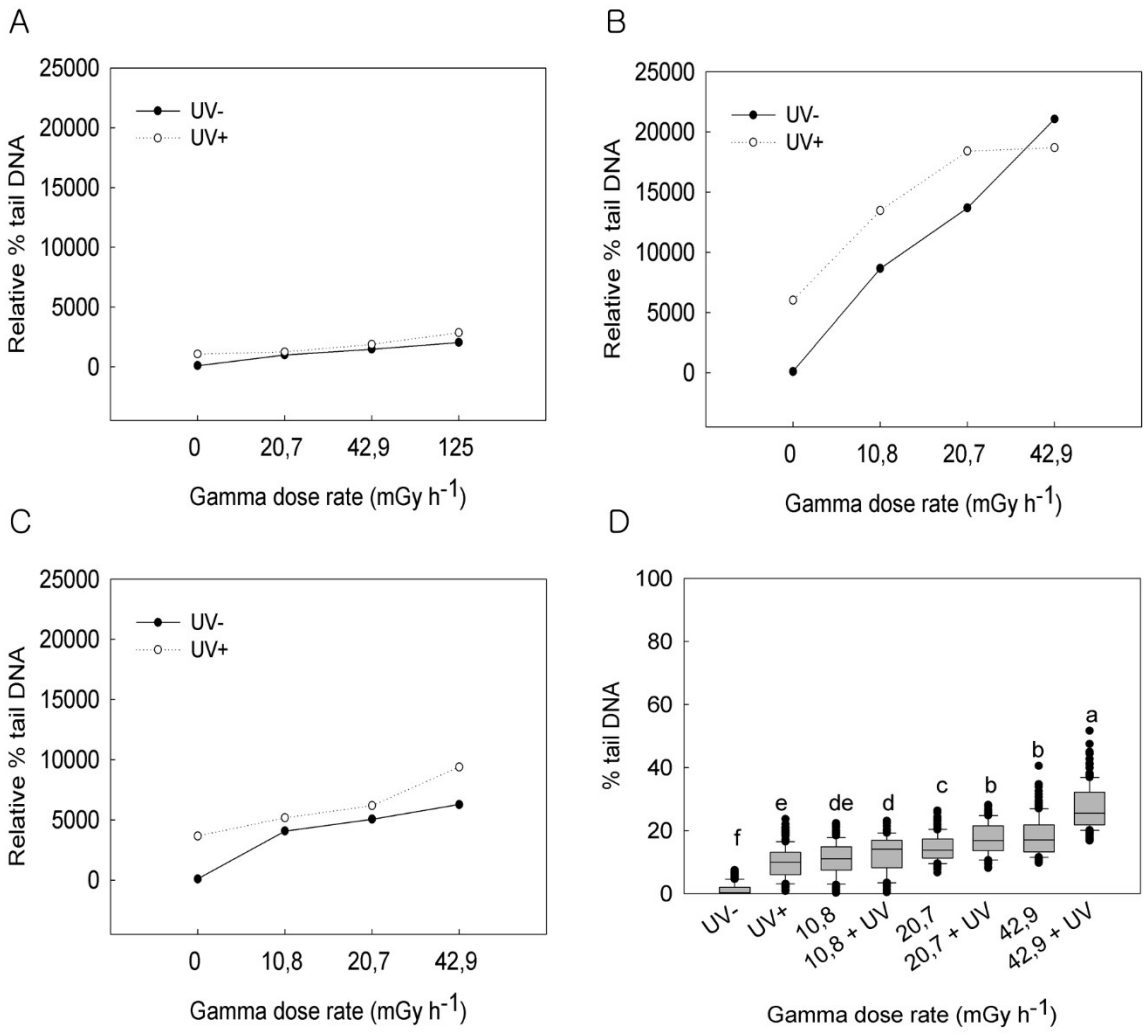
A
B
C
D
Relative % tail DNA
% tail DNA
UV-
UV+
0
5000
10000
15000
20000
25000
0
20,7
42,9
125
10,8
Gamma dose rate (mGy h-1)
0
20
40
60
80
100
f
e
de
d
c
b
b
a
UV-
UV+
10,8
10,8 + UV
20,7
20,7 + UV
42,9
42,9 + UV

Fig. S2

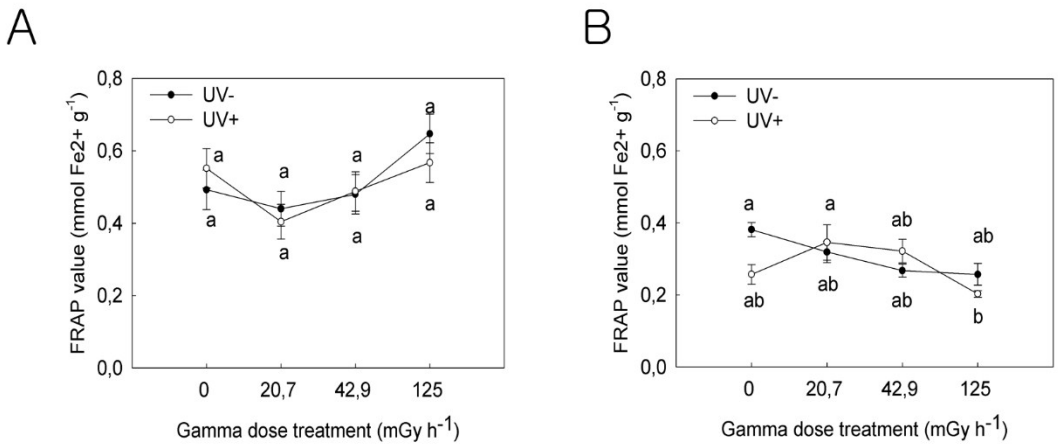
A
B
UV-
UV+
FRAP value (mmol Fe2+ g-1)
0,0
0,2
0,4
0,6
0,8
0
20,7
42,9
125
Gamma dose treatment (mGy h-1)
a
a
a
a
a
a
a
a
ab
ab
ab
ab
ab
b

Fig. S3

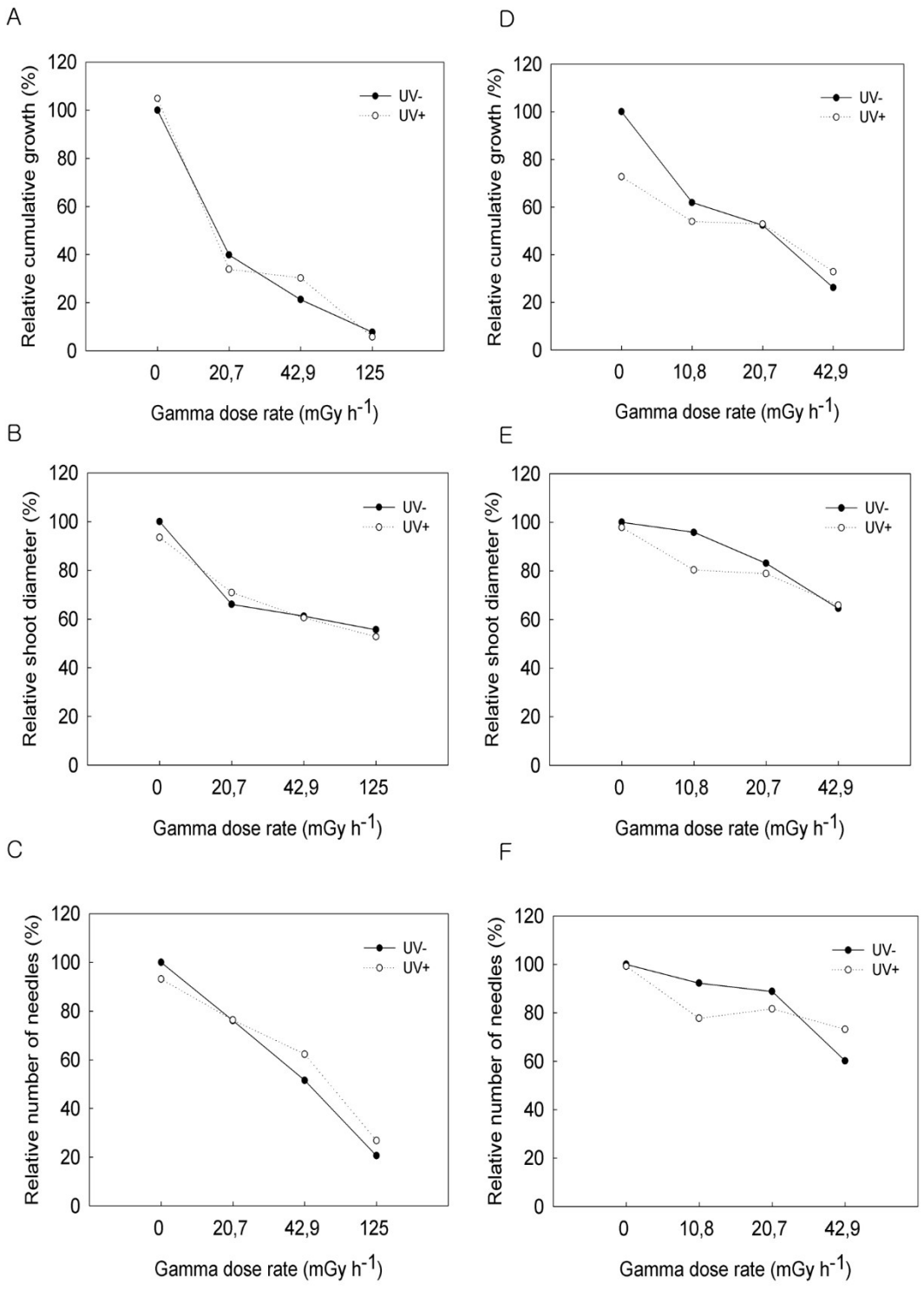
A
Relative cumulative growth (%)
120
100
80
60
40
20
0
UV-
UV+
0
20,7
42,9
125
Gamma dose rate (mGy h-1)
D
Relative cumulative growth /%)
120
100
80
60
40
20
0
UV-
UV+
0
10,8
20,7
42,9
Gamma dose rate (mGy h-1)
B
Relative shoot diameter (%)
120
100
80
60
40
20
0
UV-
UV+
0
20,7
42,9
125
Gamma dose rate (mGy h-1)
E
Relative shoot diameter (%)
120
100
80
60
40
20
0
UV-
UV+
0
10,8
20,7
42,9
Gamma dose rate (mGy h-1)
C
Relative number of needles (%)
120
100
80
60
40
20
0
UV-
UV+
0
20,7
42,9
125
Gamma dose rate (mGy h-1)
F
Relative number of needles (%)
120
100
80
60
40
20
0
UV-
UV+
0
10,8
20,7
42,9
Gamma dose rate (mGy h-1)

Fig. S4

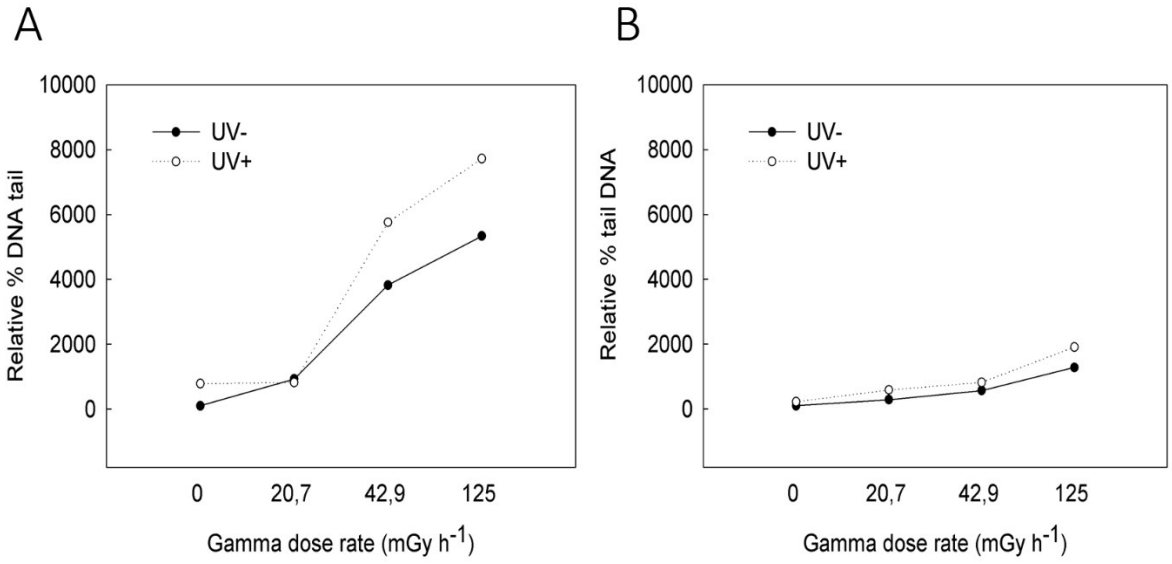
A
B
10000
8000
6000
4000
2000
0
UV-
UV+
Relative % DNA tail
Relative % tail DNA
0
20,7
42,9
125
Gamma dose rate (mGy h-1)

Fig. S5

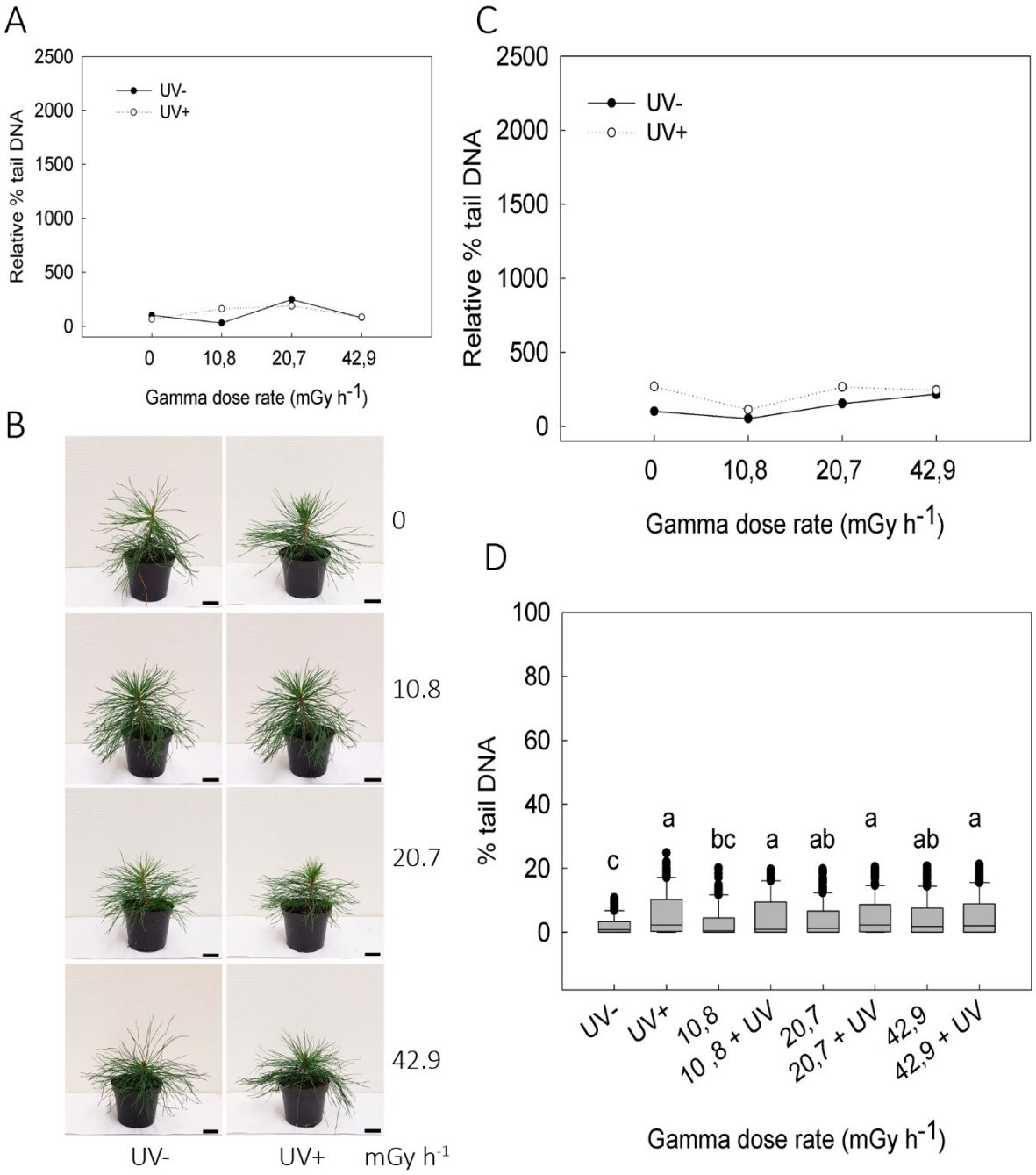
A
Relative % tail DNA
2500
2000
1500
1000
500
0
UV-
UV+
0
10,8
20,7
42,9
Gamma dose rate (mGy h-1)
B
0
10.8
20.7
42.9
UV-
UV+
mGy h-1
C
Relative % tail DNA
2500
2000
1500
1000
500
0
UV-
UV+
0
10,8
20,7
42,9
Gamma dose rate (mGy h-1)
D
% tail DNA
100
80
60
40
20
0
c
a
bc
a
ab
a
ab
a
UV-
UV+
10,8
10 ,8 + UV
20,7
20,7 + UV
42,9
42,9 + UV
Gamma dose rate (mGy h-1)

Fig. S6