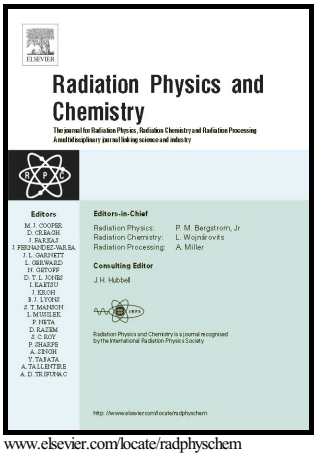
Impact of γ-rays on seed germination/short-term storage in four native alpine species: correlation with free radical and antioxidant profiles

Deborah Zani, Daniele Dondi, Susana Araujo, Andrea Mondoni, Alma Balestrazzi



www.elsevier.com/locate/radphyschem

PII: S0969-806X(16)30318-8
DOI: http://dx.doi.org/10.1016/j.radphyschem.2016.11.001
Reference: RPC7313

To appear in: *Radiation Physics and Chemistry*

Received date: 4 September 2016
Revised date: 21 October 2016
Accepted date: 2 November 2016

Cite this article as: Deborah Zani, Daniele Dondi, Susana Araujo, Andrea Mondoni and Alma Balestrazzi, Impact of γ-rays on seed germination/short-term storage in four native alpine species: correlation with free radical and antioxidant profiles, *Radiation Physics and Chemistry* http://dx.doi.org/10.1016/j.radphyschem.2016.11.001

Impact of γ-rays on seed germination/short-term storage in four native alpine species: correlation with free radical and antioxidant profiles

Deborah Zani[1], Daniele Dondi[2], Susana Araujo[1,3], Andrea Mondoni[4], Alma Balestrazzi[1*]

[1]Department of Biology and Biotechnology 'L. Spallanzani', via Ferrata 9 - 27100 Pavia, Italy

[2]Department of Chemistry, viale Taramelli 12 -27100 Pavia, Italy

[3]Instituto De Technologia Quìmica e Biologica António Xavier (ITQB-UN)L, Avenida da Republica, Estação Agronómica Nacional 2780-157-Oeiras, Portugal

[4]Department of Earth and Environmental Sciences, via S. Epifanio 14 - 27100 Pavia, Italy

[*]Correspondence to: A. Balestrazzi. Department of Biology and Biotechnology 'L. Spallanzani', via Ferrata 1, 27100 Pavia, Italy. Tel.: +390382985435; fax: +390382528496. alma.balestrazzi@unipv.it

Abstract

In this study, the impact of gamma (γ) radiation on seeds was investigated in four native alpine species, Campanula barbata L., Cirsium spinosissinum (L.) Scop., Plantago alpina L., and Silene vulgaris (Moench) Garcke. Seeds were γ-irradiated with 100 and 200 Gy total doses delivered at a dose rate of 2.7 Gy min^{-1}. Irradiated and non-irradiated seeds were used immediately, and subsequently 7 and 14 days after drying (15% Relative Humidity, 15°C) to assess their response to standard seed bank processing. Germination rates, seedling length and weight, antioxidant activity and phenolics content were measured, while free radical accumulation profiles were acquired by electron paramagnetic resonance (EPR). Germination was only hampered in irradiated C. barbata seeds. C. barbata and C. spinosissinum seedlings obtained from irradiated seeds suffered a decrease in length and weight, while growth was not affected in P. alpina and S. vulgaris, when compared to non-irradiated control. Although profiles of seed antioxidant activity were not influenced immediately after γ-irradiation, subsequent drying under seed bank standards induced changes in seed antioxidant activity, depending on the species. According to EPR data, C. barbata and C. Spinosissinum seeds revealed high free radical levels in non-irradiated samples, which were further enhanced by γ-irradiation. An opposite behaviour was observed in P. alpina and S. vulgaris. The four alpine species showed different profiles of γ-ray sensitivity. The reported data encourage future research to test inter-specific variability in the plant response to γ-rays based on a multidisciplinary approach which integrates