Effects of high-dose ionizing gamma radiation on the growth and survivability of *Cyanidioschyzon merolae*

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INTRODUCTION

Along with the development of nuclear physics, humanity studied the impact of ionizing radiation on living organisms, including higher plants and algae. However, due to the risk of radioactive contamination, it is still important to determine doses of ionizing radiation harmful to organisms, especially that organisms differ in their resistance to radiation [1]. One of the unexplored organism in this respect is *Cyanidioschyzon merolae,* a unicellular haploid red alga that inhabits acidic hot spring environments. It is characterized by simple cellular architecture, with a single chloroplast and a single mitochondrion [2].

The aim of this study was to analyse the effect of high doses of gamma radiation on growth parameters and survivability of *C. merolae.*

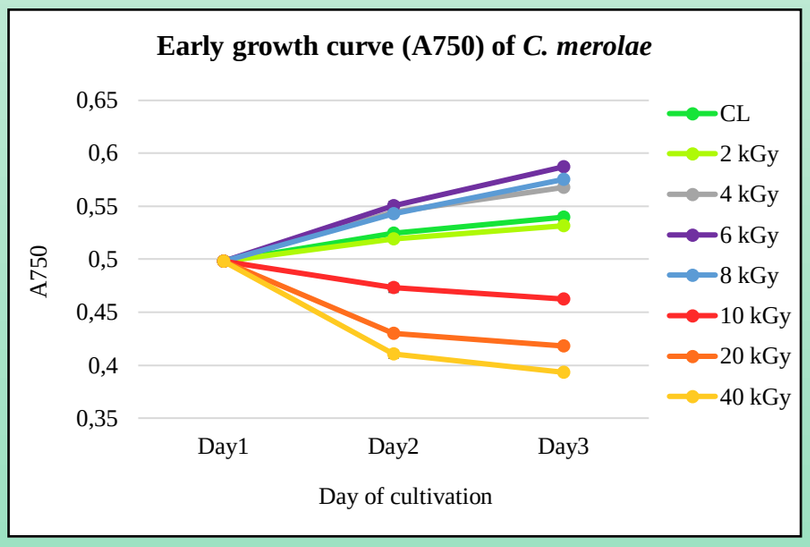
MATERIALS AND METHODS

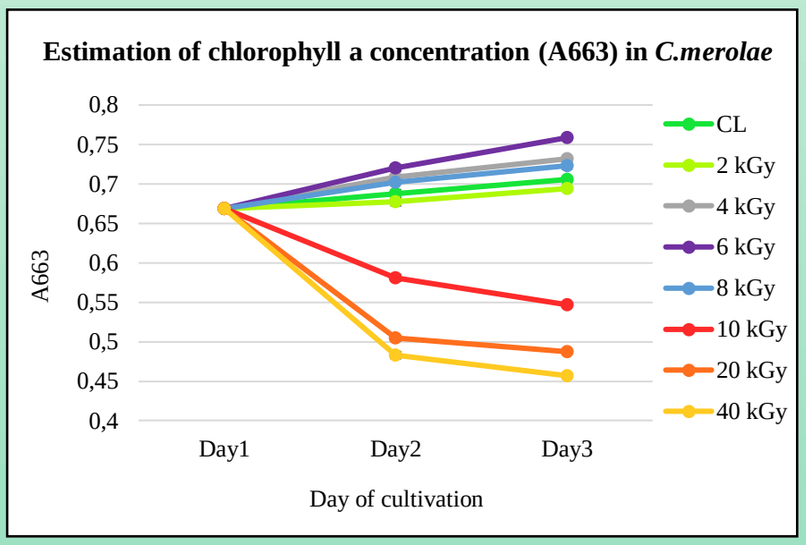
Algae, wild-type strain of *C. merolae,* were exposed to gamma radiation at seven different approximate dose rates: 2, 4, 6, 8, 10, 20, 40 kGy. Next, cultivation was conducted for several days. Growth and content of photosynthetic pigments of *C. merolae* were estimated by measuring at certain time points the optical density of the culture at the three wavelengths: 750, 663, 470 nm [2]. On the seventh day, to investigate effects of gamma radiation on photosynthetic pigments' synthesis, the contents of chlorophyll a and carotenoids were spectrophotometrically determined in selected samples.

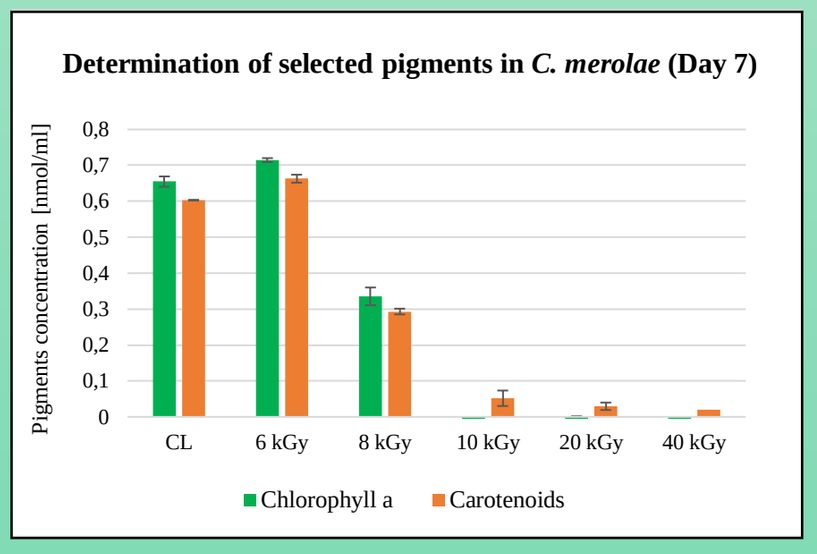
RESULTS

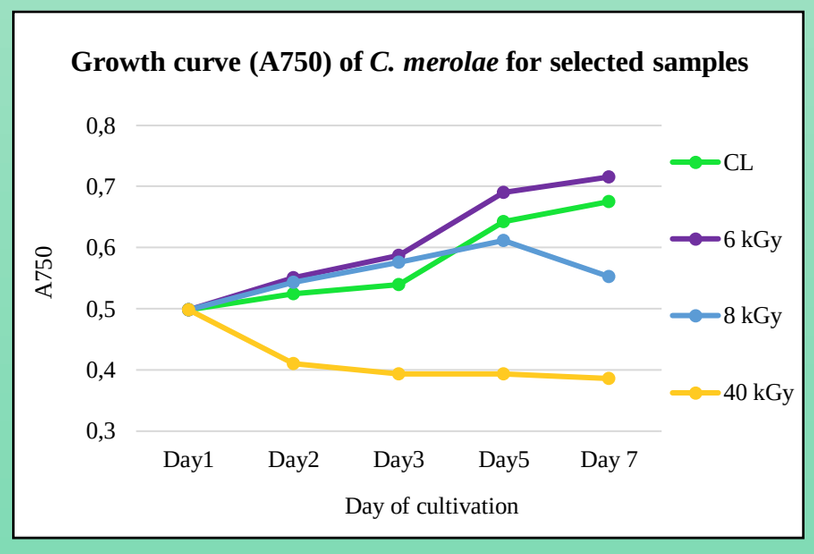
At the beginning of cultivation (day 1-3) in samples exposed to 2, 4, 6 and 8 kGy doses algae grew noticeably better than the control group. In contrast to 10, 20 and 40 kGy doses, which caused decrease of algae's growth rate and pigments concentration. Moreover, the spectrophotometric determination on day 7 showed that no pigments were left in the samples exposed to doses above 10 kGy, while in algae exposed to 8 kGy, dose compared to the 6 kGy dose and the control group, decrease of pigments concentrations was noticeable.

Spectrophotometric measurements

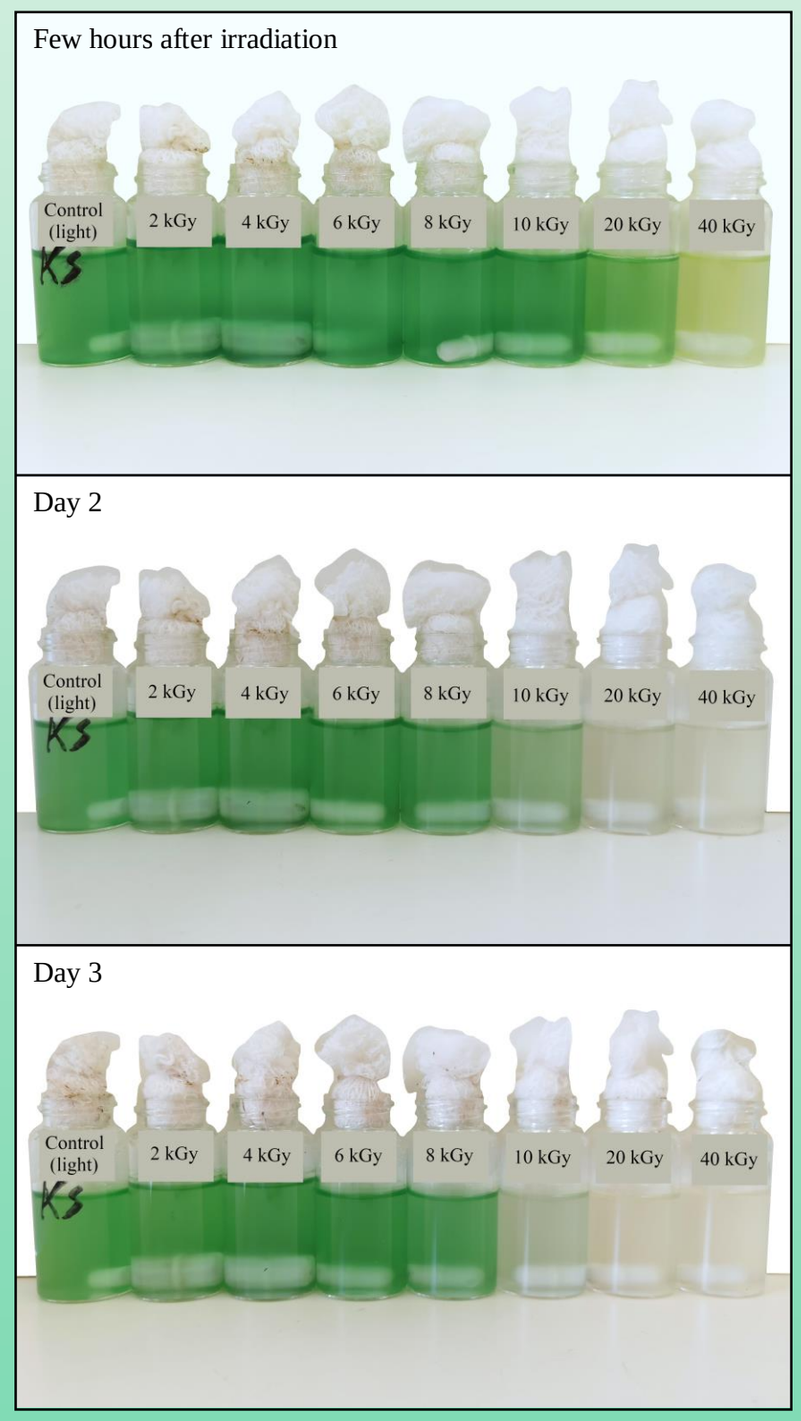








Visual observation



SUMMARY

The obtained results indicate the ability of *Cyanidioschyzon merolae* to survive relatively high doses of gamma radiation - doses above around 8 kGy exert significantly negative effect on algae's vitality. Depending on the radiation dose, the effects can be observed immediately after exposure or over the next few days. Noteworthy is the fact that after irradiation some of the samples showed faster growth rate than the control.

The obtained results indicate high resistance of *C. merolae* to ionizing radiation and should be continued in order to investigate the mechanisms of observed tolerance.

Labels on botles „2, 4, 6, 8, 10, 20, 40 kGy" mean the gamma radiation doses the samples recieved on the first day

CL, Control (light) - control grown in the visible light

REFERENCES

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[2] **Kuroiwa, T., et al.** (2017) 'Cyanidioschyzon merolae', *Springer* , pp. 35–343