

## Effects of acute gamma irradiation on physiological traits and flavonoid accumulation of *Centella asiatica*.

### ABSTRACT

In the present study, two accessions of *Centella asiatica* (CA03 and CA23) were subjected to gamma radiation to examine the response of these accessions in terms of survival rate, flavonoid contents, leaf gas exchange and leaf mass. Radiation Sensitivity Tests revealed that based on the survival rate, the LD50 (gamma doses that killed 50% of the plantlets) of the plantlets were achieved at 60 Gy for CA03 and 40 Gy for CA23. The nodal segments were irradiated with gamma rays at doses of 30 and 40 Gy for *Centella asiatica* accession 'CA03' and 20 and 30 Gy for accession 'CA23'. The nodal segment response to the radiation was evaluated by recording the flavonoid content, leaf gas exchange and leaf biomass. The experiment was designed as RCBD with five replications. Results demonstrated that the irradiated plantlets exhibited greater total flavonoid contents (in eight weeks) significantly than the control where the control also exhibited the highest total flavonoid contents in the sixth week of growth;  $2.64 \pm 0.02$  mg/g DW in CA03 and  $8.94 \pm 0.04$  mg/g DW in CA23. The total flavonoid content was found to be highest after eight weeks of growth, and this, accordingly, stands as the best time for leaf harvest. Biochemical differentiation based on total flavonoid content revealed that irradiated plantlets in CA23 at 20 and 30 Gy after eight weeks contained the highest total flavonoid concentrations ( $16.827 \pm 0.02$ ;  $16.837 \pm 0.008$  mg/g DW, respectively) whereas in CA03 exposed to 30 and 40 Gy was found to have the lowest total flavonoid content ( $5.83 \pm 0.11$ ;  $5.75 \pm 0.03$  mg/g DW). Based on the results gathered in this study, significant differences were found between irradiated accessions and control ones in relation to the leaf gas. The highest PN and gs were detected in CA23 as control followed by CA23 irradiated to 20Gy (CA23G20) and CA23G30 and the lowest PN and gs were observed in CA03 irradiated to 40Gy (CA03G40). Moreover, there were no significant differences in terms of PN and gs among the irradiated plants in each accession. The WUE of both irradiated accessions of *Centella asiatica* were reduced as compared with the control plants ( $p < 0.01$ ) while Ci and E were enhanced. There were no significant differences in the gas exchange parameters among radiated plants in each accession. Moreover, malondialdehyde (MDA) of accessions after gamma treatments were significantly higher than the control, however, flavonoids which were higher concentration in irradiated plants can scavenge surplus free radicals. Therefore, the findings of this study have proven an efficient method of in vitro mutagenesis through gamma radiation based on the pharmaceutical demand to create economically superior mutants of *C. asiatica*. In other words, the results of this study suggest that gamma irradiation on *C. asiatica* can produce mutants of agricultural and economical importance.

**Keyword:** *Centella asiatica*; Gamma irradiation; Total flavonoid; Photosynthesis.