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Developmental stage determines the accumulation pattern of UV-absorbing compounds in the model liverwort Marchantia polymorpha subsp. ruderalis under controlled conditions

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The liverwort Marchantia polymorpha subsp. ruderalis is emerging as a new model plant, but relatively little is known on basic aspects of its physiology and responses to environmental factors (particularly, UV radiation). Thus, our aim was to study the influence of the developmental stage on the accumulation patterns of phenolic UV-absorbing compounds (UVACs) in samples exposed and non-exposed to UV radiation. Samples of three different developmental stages (gemmae, one-month-aged thalli and two-month-aged thalli) were exposed to only PAR (P regime) and to a combination of PAR + UV-A + UV-B radiation (PAB regime) for 38 days, using moderate realistic UV doses. At the end of this period, the bulk level of methanol-soluble UVACs and the contents of six soluble individual UVACs (derivatives of apigenin and luteolin) were measured.

Both the radiation regime and the developmental stage strongly influenced UVACs accumulation pattern, and the responses to UV radiation were different in the diverse developmental stages. Plants exposed to UV from juvenile stages (gemmae or 1-month age thallus) were the most UV-responsive and showed a strong increase in every UVAC measured, being the increase stronger in the most juvenile stage. However, when samples were exposed to UV from 2-month age thalli, only apigenin derivatives increased and more modestly. In fact, the phenolic profile of these plants was not very different from the profile of the plants non-exposed to UV. Thus, as age increased, the responses to UV were weaker, probably due to senescence and a consequent decrease in metabolic responsiveness. Nevertheless, the thalli became progressively tougher due to continuously decreasing water content, representing a possible structural protection against excess UV. On the other hand, 1-month age thalli exposed to UV radiation showed a transitory conversion of apigenin mono-glucuronide into apigenin di-glucuronide. In plants non-exposed to UV, temporal variations of UVACs were much less marked and compound dependent. A PCA ordination of the different samples summarized the findings described above.

The pattern described should be taken into account in experiments in which accumulation of UV-inducible compounds is expected, in order to select the adequate thalli age and better interpret the results obtained.

Keywords: Marchantia, physiologic UV responses, phenolic compounds, age-dependent.