

SUNLIGHT STRESS-INDUCED CHANGES IN ISOQUINOLINE ALKALOIDS PRODUCTION OF IPECACUANHA PLANTS

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Introduction

Substances produced by the secondary metabolism of plants often exhibit a range of biological and pharmacological activities, with alkaloids being one of the most studied classes of natural plant products, due to their pharmacological activities^[1]. Thus, different approaches are used in plant studies to promote the increased concentration of certain substances of interest in these plants, and most plants respond with increased biosynthesis of their active principles when elicited by abiotic and biotic factors and even when grown outside their habitat^[2].

Carapichea ipecacuanha produces in its roots, isoquinoline alkaloids, emetine and cephalin, and its extract is used in several preparations and pharmaceutical formulations^[3]. However, it is included in the Red Book, of plants threatened with extinction^[4], mainly due to the rampant extraction in the forest, for the commercialization of their roots. Their habitat is in a shaded environment, with a shading of 70%^[5], indicated for its cultivation in greenhouses, as it is closer to the forest's understory environment.

Thus, the aim was to relate the photochemical response with the production of isoquinoline alkaloids, emetine and cephalin, in *C. ipecacuanha* plants, when cultivated at different shading levels (90, 70 and 50%) and in full sunlight, for three days.

Material and Methods

Plants of *Carapichea ipecacuanha* were cultivated in an 8 L-pot containing sandy soil and kept in shade (90, 70 and 50%). The treatments were: shading of 50, 70 and 90% (controls); shading of 50, 70 and 90 + direct full sunlight exposure for three days; and full sunlight (50 days of direct sun exposure). Plants with 70% shading were considered the control treatment for plants under full sunlight (50 days), given its indication as an adequate condition for the cultivation of ipecacs in artificial environments^[5].

Chlorophyll fluorescence analysis was measured using a portable fluorometer (Handy PEA Model, Hansatech Instruments, King's Lynn, Norfolk, UK). The leaves were dark-adapted for 30 min. Transient fluorescence intensities were measured between 50 μ s (initial fluorescence - F₀) and 1 s; values were calculated as proposed by Strasser et al.^[6,7].

For extraction and quantification of isoquinoline alkaloids, (\pm 2 g) of roots were used, which after lyophilization yielded approximately 500 mg for extraction in methanol. The quantitative analysis of the alkaloids was performed as described by Han^[8], with adaptations.

Results / Discussion

All treatments submitted to full sunlight showed disorders in the electron transport chain of photosynthesis (ETC). However, the effect of excess light was evidenced more accurately in J-step. Thus, three days of full sunlight for the treatment with 90% shading + exposure to full sunlight was very stressful, as it showed complete loss of the curve, reflecting a loss of connectivity between the photosystems and consequently influencing the final energy production. The activities of the complexes involved in the flow of these electrons prove the decrease in this energy and the loss of the maximum photochemical efficiency attributed to photosystem II (Fv/Fm) [9].

For the production of alkaloids emetine and cephalin, the exposure of ipecac plants to full sunlight promoted an increase in these metabolites, especially when exposed longer to full sunlight. This was noticeable when comparing the emetine content of the full sunlight treatment with its control (70% shaded), with an increase of 45% for the full sunlight treatment. This same analysis, but for cephalin, showed a lower production for the full sunlight treatment, among all the analyzed treatments and the highest cephalin content was for plants exposed for 3 days that left the shading of 90%.

Conclusion

All treatments, when exposed to full sunlight showed changes in photochemical activity, reflecting on the production of secondary metabolism, with a higher production of emetine and cephalin, but this being dependent on the level of shading and the of time exposure to full sunlight.

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