

Population Diversity of Dalmatian Pyrethrum Based on Pyrethrin Content and Composition

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Abstract : Dalmatian pyrethrum (*Tanacetum cinerariifolium* /Trevir./ Sch. Bip.), a species endemic to the eastern Adriatic coastline, is the source of natural insecticide pyrethrin. Pyrethrin is a mixture of six compounds (pyrethrin I and II, cinerin I and II, jasmolin I and II) that exhibits high insecticidal activity with no detrimental effects to the environment. A recently optimized matrix-solid phase dispersion method (MSPD), using florisil as the sorbent, acetone-ethyl acetate (1:1, v/v) as the elution solvent, and sodium sulfate anhydrous as the drying agent was utilized to extract the pyrethrins from 10 wild populations (20 individuals per population) distributed along the Croatian coast. All six components in the extracts were qualitatively and quantitatively determined by high-performance liquid chromatography with a diode array detector (HPLC-DAD). Pearson's correlation index was calculated between pyrethrin compounds, and differences between the populations using the analysis of variance were tested. Additionally, the correlation of each pyrethrin component with spatio-ecological variables (bioclimate, soil properties, elevation, solar radiation, and distance from the coastline) was calculated. Total pyrethrin content ranged from 0.10% to 1.35% of dry flower weight, averaging 0.58% across all individuals. Analysis of variance revealed significant differences between populations based on all six pyrethrin compounds and total pyrethrin content. On average, the lowest total pyrethrin content was found in the population from Pelješac peninsula (0.22% of dry flower weight) in which total pyrethrin content lower than 0.18% was detected in 55% of the individuals. The highest average total pyrethrin content was observed in the population from island Zlarin (0.87% of dry flower weight), in which total pyrethrin content higher than 1.00% was recorded in only 30% of the individuals. Pyrethrin I/pyrethrin II ratio as a measure of extract quality ranged from 0.21 (population from the island Čiovo) to 5.88 (population from island Mali Lošinj) with an average of 1.77 across all individuals. By far, the lowest quality of extracts was found in the population from Mt. Biokovo (pyrethrin I/II ratio lower than 0.72 in 40% of individuals) due to the high pyrethrin II content typical for this population. Pearson's correlation index revealed a highly significant positive correlation between pyrethrin I content and total pyrethrin content and a strong negative correlation between pyrethrin I and pyrethrin II. The results of this research clearly indicate high intra- and interpopulation diversity of Dalmatian pyrethrum with regards to pyrethrin content and composition. The information obtained has potential use in plant genetic resources conservation and biodiversity monitoring. Possibly the largest potential lies in designing breeding programs aimed at increasing pyrethrin content in commercial breeding lines and reintroduction in agriculture in Croatia. Acknowledgment: This work has been fully supported by the Croatian Science Foundation under the project 'Genetic background of Dalmatian pyrethrum (*Tanacetum cinerariifolium* /Trevir/ Sch. Bip.) insecticidal potential' - (PyrDiv) (IP-06-2016-9034).

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