

Foliar spraying of salicylic acid induced accumulation of phenolics, increased radical scavenging activity and modified the composition of the essential oil of water stressed *Thymus vulgaris* L

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Abstract

Polyphenolic compounds are considered valuable secondary plant metabolites owing to the myriad of biological activities they exert. This study aimed to investigate the effect of applying various concentrations of the plant growth regulator, salicylic acid (SA), on *Thymus vulgaris* L. while subjecting the plant to decreasing amounts of irrigation water. The following parameters were monitored; total polyphenolic and flavonoid content, yield and composition of the essential oil, and antioxidant activity of the alcoholic extracts. Drought alone significantly ($P < 0.05$) increased the polyphenolic and flavonoid content, yield of the essential oil and antioxidant activity. The total flavonoid content in control plants was 6.1 ± 0.3 mg/gm dry weight calculated in terms of rutin equivalent. However, in drought stressed plants, (irrigated at 25% of the field capacity) sprayed with 3 mM SA, the flavonoid content increased to 32.1 ± 0.1 mg/gm dry weight calculated in terms of rutin equivalent. Moreover, the total phenolic content increased from 8.5 ± 0.3 to 68.5 ± 1.2 mg/gm dry weight calculated in terms of gallic acid in the same test plants. Radical scavenging activity, using DPPH assay, was measured for the different plant treatments. A decrease from 74.4 ± 0.4 $\mu\text{g/ml}$ to 36.6 ± 0.9 $\mu\text{g/ml}$ of IC50 was recorded in the drought stressed plants (25% FC) sprayed with 3 mM SA compared with the control plants. The variability in polyphenolic composition between the control plants and plants with the highest total polyphenolic content was investigated by UPLC-ESI-MS/MS. Rosmarinic acid was detected as the major component in samples from both treatments, with a higher percentage observed upon subjecting the plant to the test conditions (25% FC and sprayed with 3 mM SA). The highest yield of the essential oil (1 ± 0.06 %v/w) was obtained from drought stressed plants (25% FC) sprayed with 2 mM SA. GC/MS analysis of oil samples revealed that the Thymol content increased with drought stress, while that of p-cymene decreased. However, an increase of p-cymene was witnessed as a result of SA spraying.

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