



Elevated temperature and water shortage effects on leaf physiological and morphological traits of *Vitis vinifera* L. cv. Assyrtiko

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Scope

In the context of climatic change, high temperatures and water deficiency pose severe impacts in **viticulture** [1,2]. It is expected that climatic change will affect **viniculture in the Mediterranean region**. In the present study morphological, anatomical and physiological traits of grapevine (*Vitis vinifera* L.) cultivar (cv.) Assyrtiko [3,4] leaves grown under abiotic stress conditions (i.e., increased temperature and water deficiency) were investigated and evaluated.

Introduction

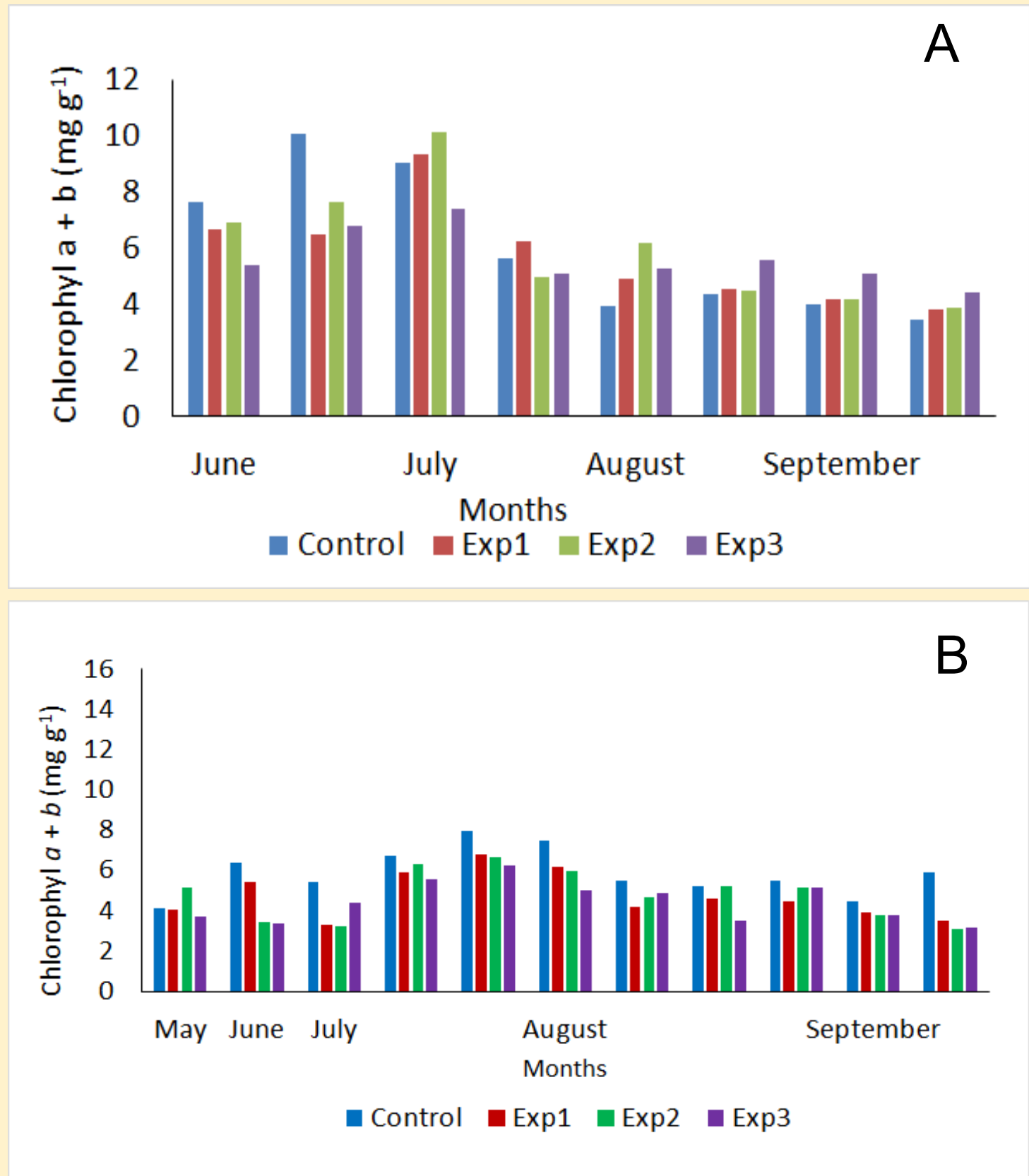
Vitis vinifera L. is a winter deciduous perennial, long-lived plant of great economic value, grown in regions with Mediterranean climate [5-7], as well as in a wider range of climates, such as in semi-arid and tropical regions [6,8]. Summer water deficit is considered the main environmental constraint for plant growth in Mediterranean-type ecosystems. Under Mediterranean climatic conditions, the physiological regulation of water use in response to soil water depletion is essential for species survival, productivity and distribution.

Methodology

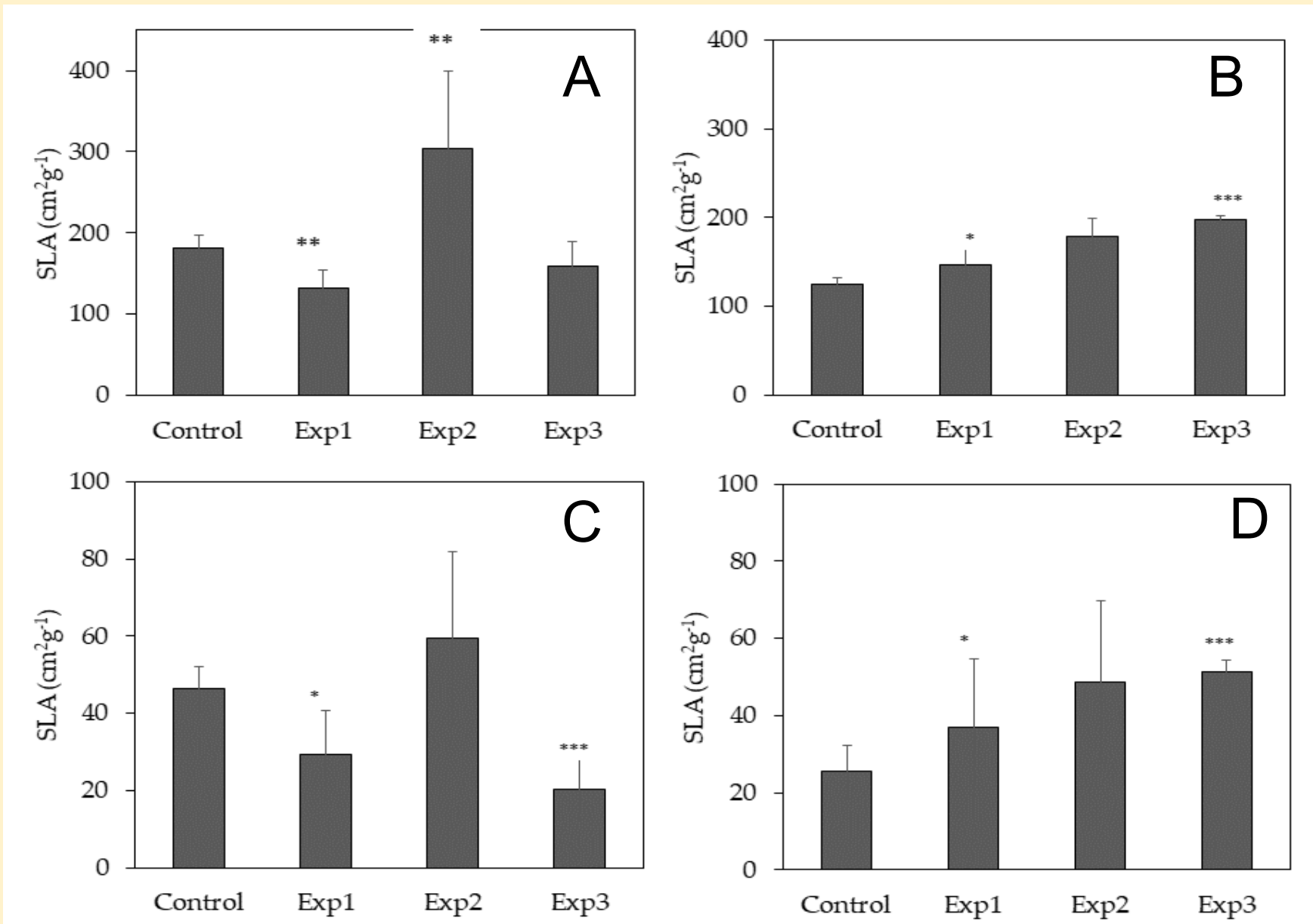
In the first experiment, 2-year-old grapevine plants were placed in a growth chamber (GC), while in the second experiment 2-year-old grapevines were planted in an open-air vineyard (EC) on Aegina Island in Greece. In both experiments, four environmental treatments were applied, regarding temperature (ambient vs ambient +2° C) and water availability (full irrigation vs cyclic drought). The **1st group** included well-watered plants (control). The **2nd group** of plants (exp1) included less watered plants by 30% than that of the 1st group. The **3rd group** of plants (exp2) was transferred to a second chamber with higher ambient temperature by 2° C, and was well watered. The **4th group** of plants (exp3) was transferred to the second chamber (elevated temperature), and the irrigation was 30% lower than that of the control plants.

Results and Discussion

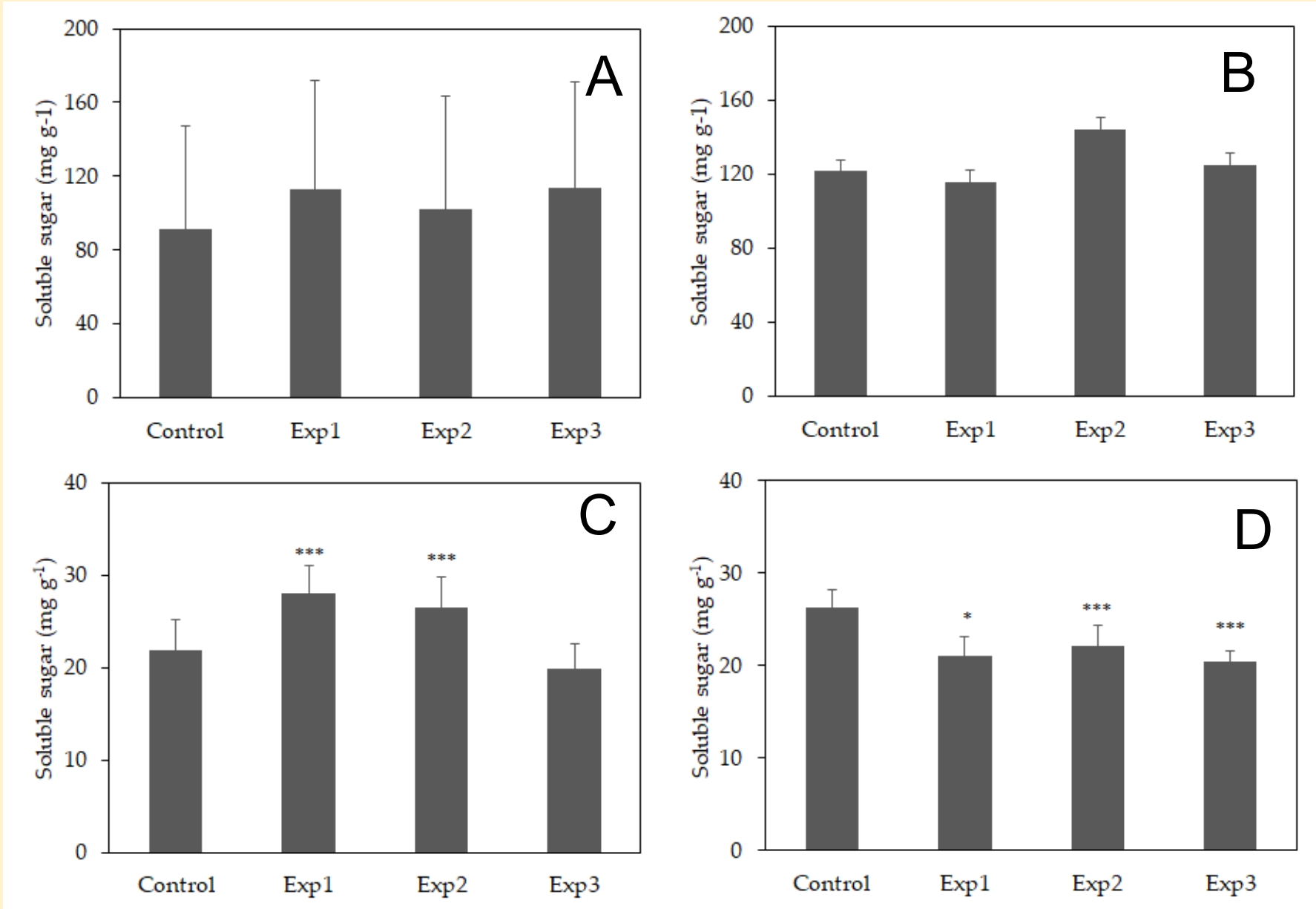
The concentration of chlorophyll *a+b* was reduced in the water-stressed expanded leaves. A decrease of the specific leaf area (SLA) in the expanding and an increase in the expanded leaves was detected in plants exposed to both experimental conditions. Concerning, the anatomical leaf traits, the spongy parenchyma was reduced in the expanding leaves and increased in the expanded leaves. The soluble sugars were significantly decreased in the expanded leaves, in comparison to the expanding leaves. It is likely that according to the physiological and morphological findings, expanding and fully expanded leaves of the **grapevine** *Vitis vinifera* L. cv. Assyrtiko responded differently to water shortage and elevated temperature; this may affect the plant productivity.



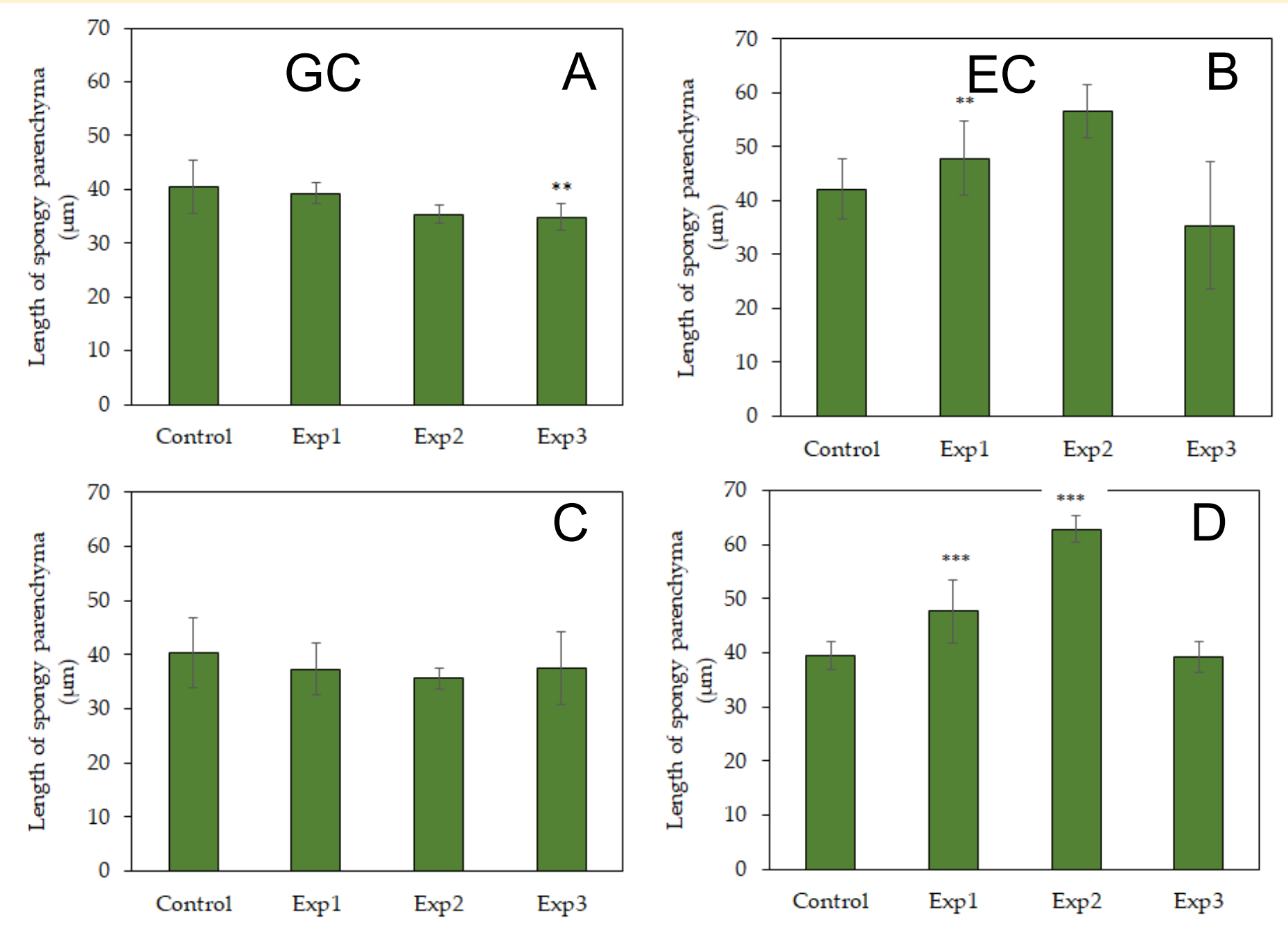
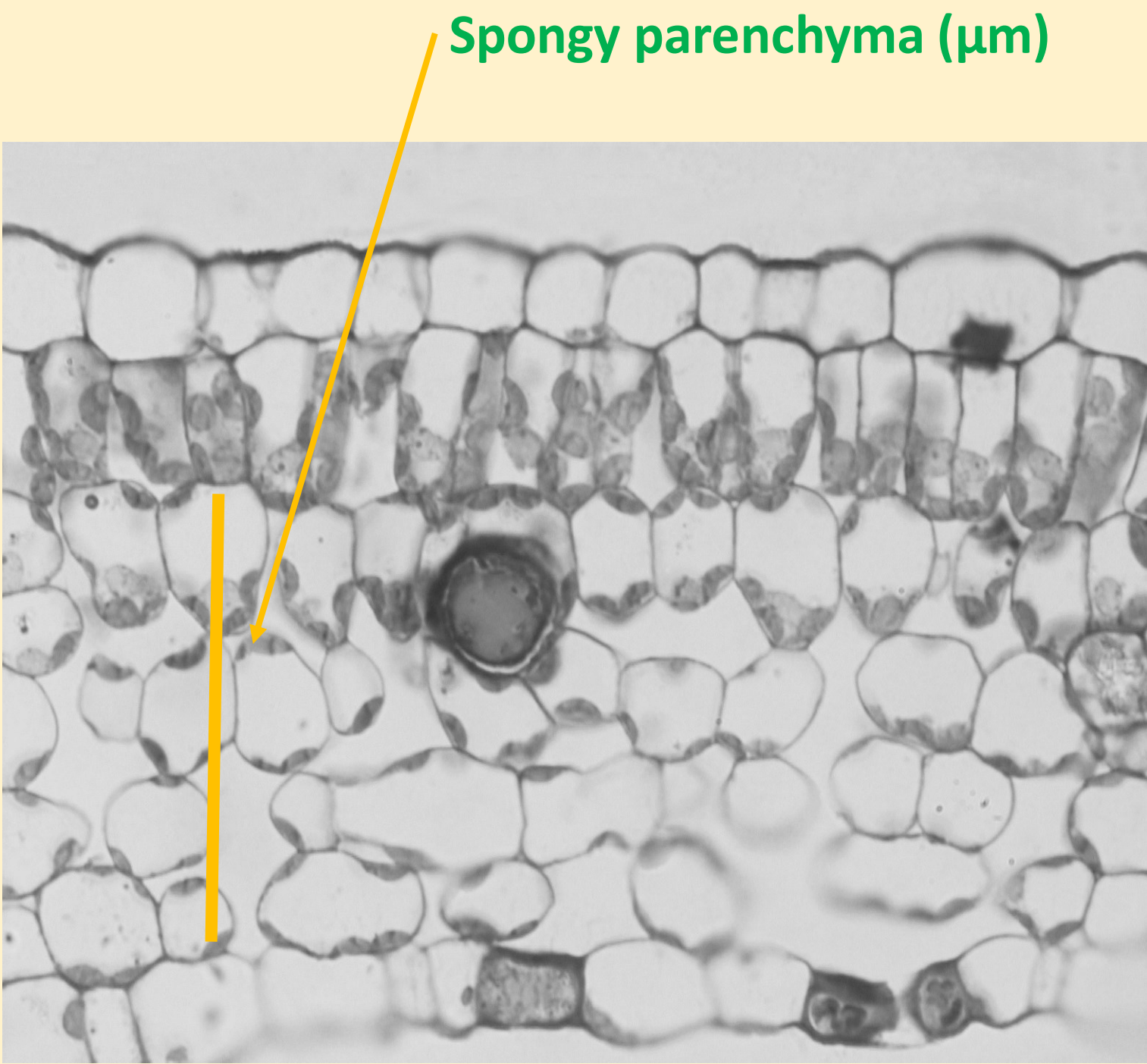
Chlorophyll *a + b* of fully expanded leaves (A) grown under GC conditions and fully expanded leaves (B) grown under EC conditions.



SLA of young expanding (A) and fully expanded leaves (B) grown under GC conditions, and young expanding leaves (C) and fully expanded leaves (D) grown under EC conditions. P-values, ns: p>0.05, *: p<0.05, **: p<0.01, ***.



Soluble sugars of young expanding (A) and fully expanded leaves (B) grown under GC conditions, and young expanding (C) and fully expanded leaves (D) grown under EC conditions. P-values, ns: p>0.05, *: p<0.05, **: p<0.01, ***.



Length of spongy parenchyma (µm) of young expanding (A,C) and fully expanded (B, D) leaves of *Vitis vinifera* cv. Assyrtiko under GC and EC conditions. P-values, ns: p>0.05, *: p<0.05, **: p<0.01, ***.

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