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Effect of canopy damage in *Quercus ilex* due to the storm Juliette on three epiphytic mosses

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PMMR contact and more information about Juliette in Mallorca:

Introduction

Climate change is expected to increase the frequency and intensity of **extreme climatic events** in the Mediterranean Basin, such as drought, heat waves or intense storms. The last can physically damage trees, affecting their canopy. In turn, it can affect **epiphytes** (which depend on the microclimatic conditions generated by their phorophytes) due to their sudden exposure to harsher conditions of temperature, light and humidity.

In February 2023, the squall **Juliette** hit the Balearic Islands. Within 48 h, snow accumulation reached up to 300 cm and wind speeds up to 122 km/h were recorded. This squall heavily affected many *Quercus ilex* L. forests in Mallorca, thus exposing many epiphyte communities to harsher environmental conditions.

In this study, we aimed to evaluate the effect of sudden exposure due to Juliette on three *Q. ilex* epiphytic mosses.

Methodology

The study was conducted at Finca de Menut, in the Serra de Tramuntana (Mallorca, Spain; 39°50'01.4"N 2°53'58.6"E). Three types of sampling *Quercus ilex* trees were considered (characterized through PAR measurements, Fig. 1):

- Unaffected trees with epiphytes sheltered by the canopy (**N**).
- Unaffected trees with epiphytes previously exposed, not sheltered by the canopy (**P**).
- Affected trees with previously sheltered epiphytes but exposed after Juliette (**T**).

Three epiphytic mosses growing on *Q. ilex* were selected for the study: ***Homalothecium sericeum***, ***Leucodon sciuroides*** and ***Leptodon smithii*** (Fig. 2).

Percentage of moss dead branches was monitored on April, August and December 2023. Samples were taken on April and December 2023 to assess the oxidative stress levels and biochemical response of the epiphytes through **F_v/F_m**, **TBARS** and **pigment concentration** analyses.

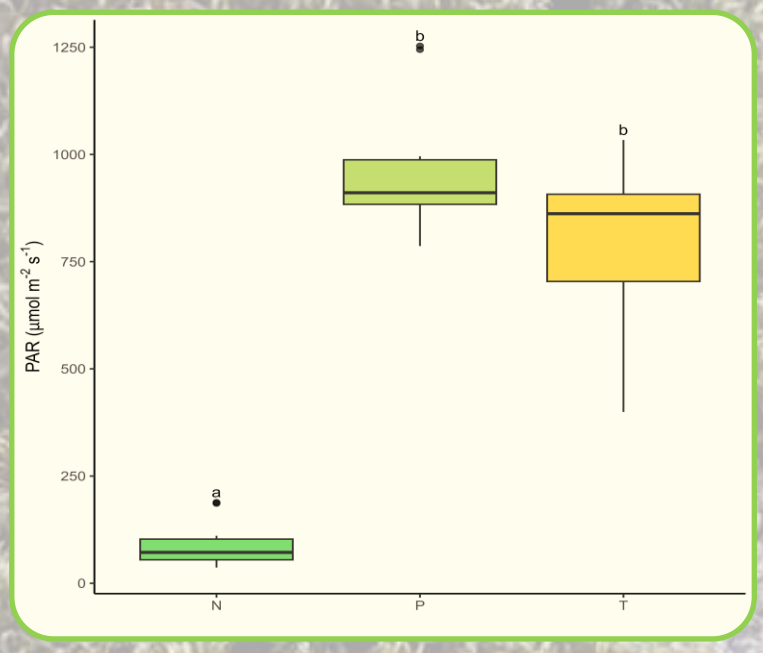
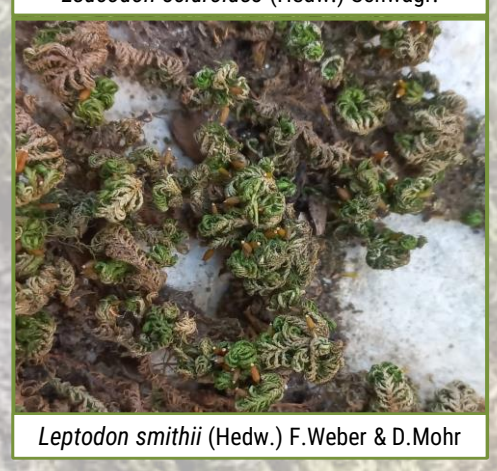


Figure 1. Tree type characterization through PAR measurements. n= 10. Different letters represent statistically significant differences (P< 0.001).

Homalothecium sericeum (Hedw.) Schimp.

Leucodon sciuroides (Hedw.) Schwägr.



Leptodon smithii (Hedw.) F.Weber & D.Mohr

Figure 2. Study species. © PMMR

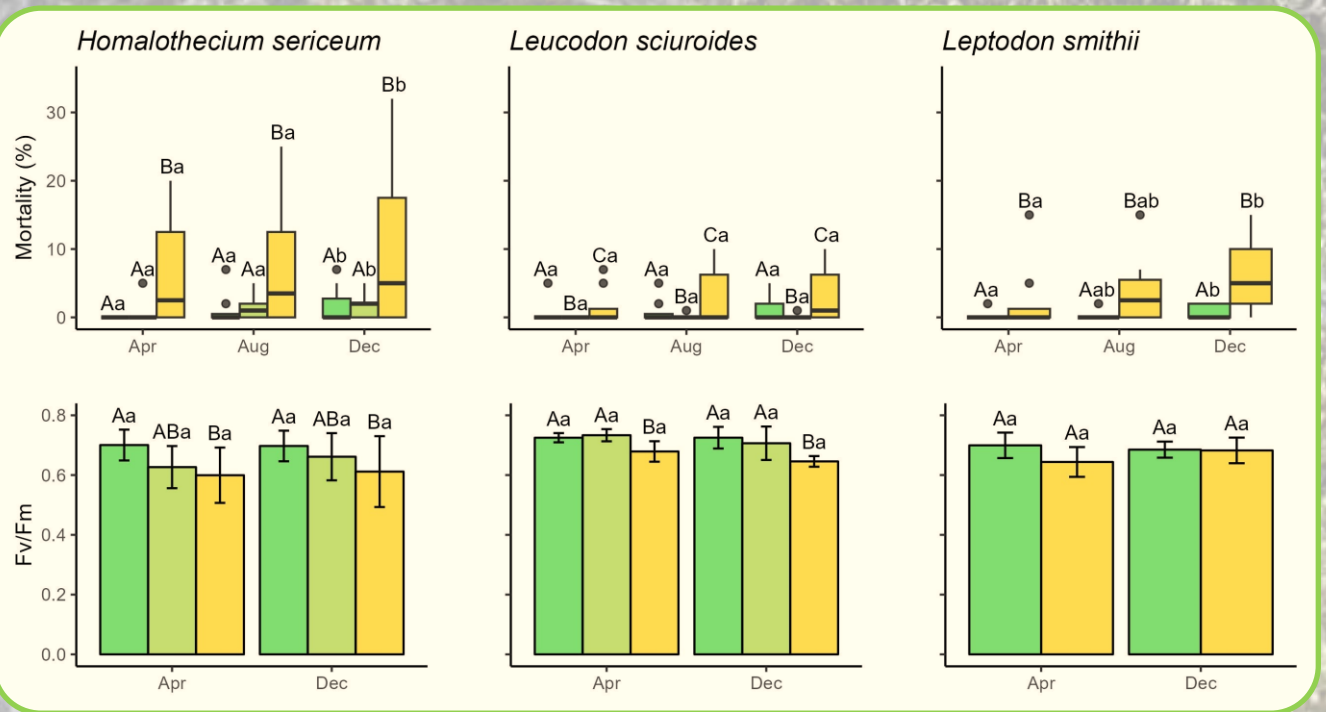


Figure 3. Percentage of dead branches and F_v/F_m values for the species of study during the time of sampling. Colors indicate the type of sampling tree as in Fig. 1. n= 8. Different letters represent statistically significant differences (P< 0.05) among types of trees (capital letters) and sampling times (minor letters).

Results and Discussion

Branch mortality rates significantly increased in the T trees, although they remained low during the time of study, and at **0** for some samples independently of the tree type (**Fig. 3**). F_v/F_m levels decreased in *H. sericeum* and *L. sciuroides* growing on T trees, while T *L. smithii* did not show a significant affectation (although being the only species for which P trees were not found). None of the species showed significant oxidative damage levels, as there were no significant differences among types of trees for TBARS levels (**Fig.4**). *H. sericeum* showed an increase in total chlorophylls and a decrease in the carotenoids to chlorophylls ratio in T samples. This could be considered as an **acclimation mechanism** to the new exposed conditions, since these changes showed a trend towards a similarity with P samples. *L. sciuroides* and *L. smithii* did not show changes in pigment contents, but these species could protect themselves by exposing their non-photosynthetic partes while hiding the photosynthetic, vulnerable ones when dry (pers. obs.)

Conclusions

The study species showed **low levels of affectation** due to sudden exposure. Low mortality rates and oxidative damage could be maintained through **pigment production and/or morphological adaptations**.

Future questions

- How will the study species change their biochemistry (in terms of pigment concentration) during long-term exposure?
- How will epiphytic communities (including foliose liverworts and lichens) evolve after exposure?
- How will exposure affect epiphytic mosses productivity, reproduction and recruitment?

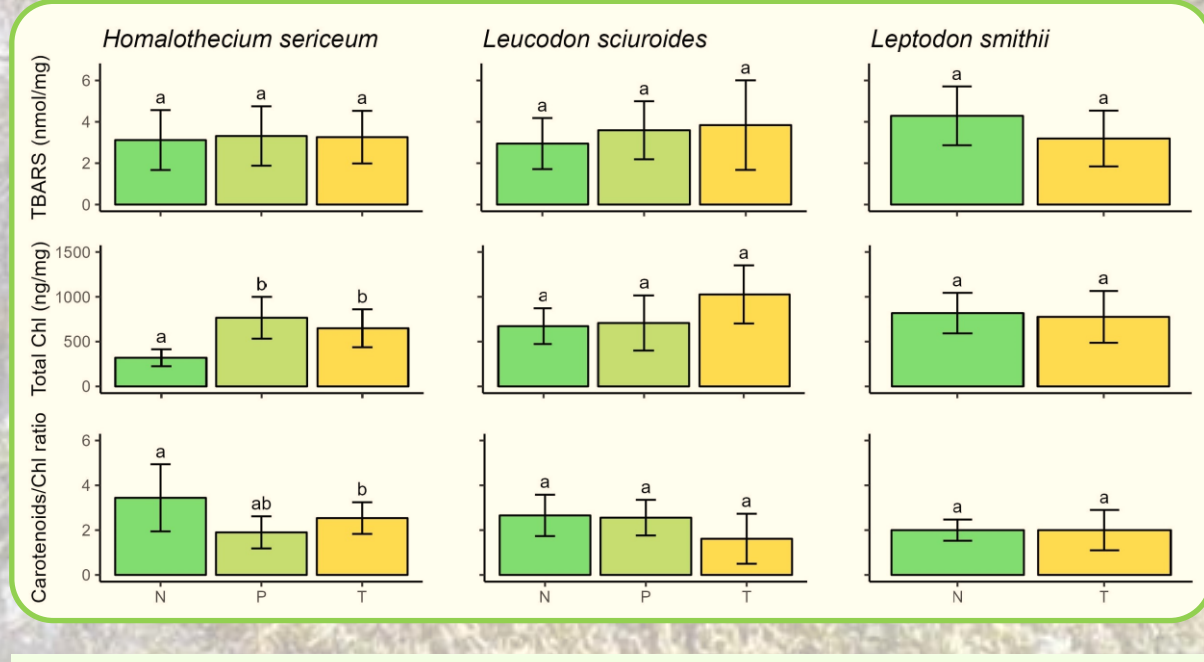


Figure 4. TBARS, total chlorophyll (a+b) and carotenoid to total chlorophyll ratio for the species of study sampled on April 2023. Concentrations were normalized per mg of dry weight. n= 8. Different letters represent statistically significant differences (P< 0.05) among types of trees.

Aknowledgements

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