

Mines bigger than yours:

Responses of leaf-mining larvae to elevated carbon dioxide.

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Background

It remains unclear how insect herbivory will affect the response of woodlands to increasing concentrations of atmospheric carbon dioxide (eCO₂). Herbivores may consume more to compensate for increasing plant C:N^[1], or, alternatively, plants may be better able to defend against herbivores, resulting in reduced feeding and stunted herbivore growth^[2]. The Birmingham Institute of Forest Research (BIFoR) Free Atmosphere Carbon Enrichment (FACE) facility provides a unique opportunity to investigate these responses in a mature woodland. Leaf-miners are an excellent model group of herbivores to study in this system as they are sessile, abundant and their entire larval life history is captured in the trace they leave as they feed.

Objectives

- Record the density and diversity of leaf-miners within the experimental arrays at the BIFoR FACE facility.
- Investigate the potential effects of eCO₂ on mean mine area.
- Determine if arrays provide a good representation of miner activity across the site.



Figure 1.

Methods

- Total of 6 arrays split into 3 adjacent pairs of treatment (+150ppm CO₂) and control.
- 200 English Oak, *Quercus robur*, leaves surveyed in each array (total 1200) in 2017 and 2018 and number of mines recorded.
- 20 leaves containing mines imaged and mine area calculated using ImageJ software (Fig. 1).
- The miner responsible was identified to Genus level.

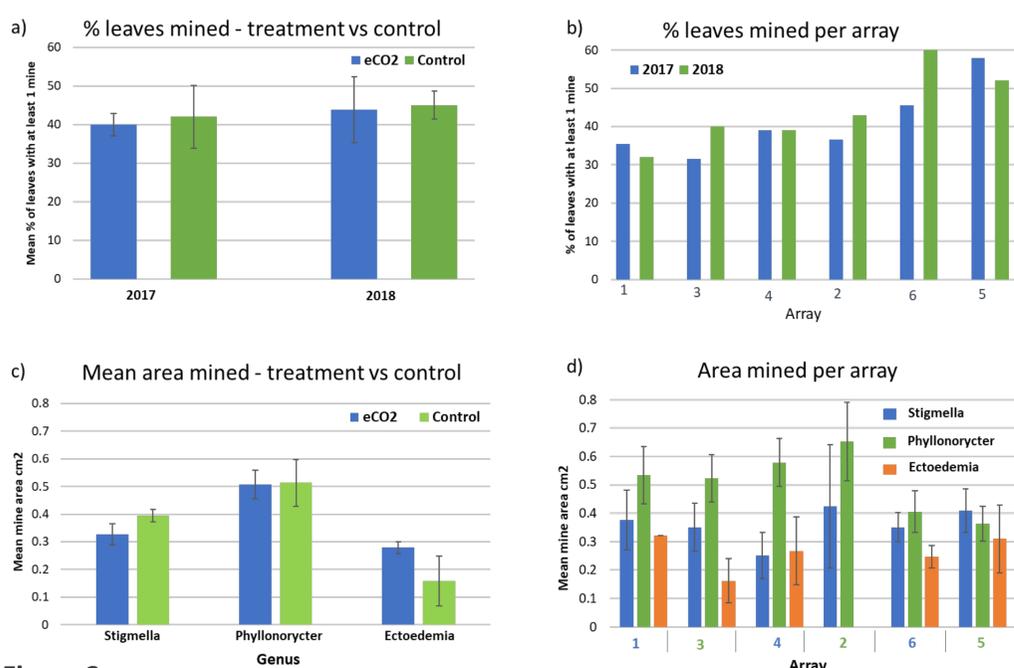


Figure 2.

Results

A total of 743 mines in 2017 and 757 mines in 2018 were recorded from 4 genera. The presence of at least 1 mine was recorded from 41% and 44% of these leaves in 2017 and 2018 respectively (Fig. 2, a & b).

There was no significant difference in density or mean area of mines between eCO₂ and control (Fig. 2, a & c).

There was no significant difference in mine density or mean mine area within array pairs, although there were differences between pairs (Fig. 2, b & d).

Blotch mines from the Genus *Phyllonorycter* were the most abundant and also had the largest mean area (Fig 2, c).

Take home message

- The high density of mines (>40% of leaves) demonstrates importance of leaf-miners at ecosystem level and the key Genera were identified.
- Array pairings provide good representation of miner activity across site.
- Data suggest no clear response to eCO₂ in first year, which contradicts some other studies^[3], but responses in a mature woodland will likely be slow, and monitoring at BIFoR will continue for at least 10 years.

References:

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