Direct and interactive effects of light availability and insect herbivory on inducibility of chemical defences in young pine trees

Xosé López-Goldar, Luis Sampedro, Rafael Zas
Misión Biológica de Galicia, MBG-CSIC. 36080 Pontevedra, Galicia, Spain.
E-mail: **xlgoldar@gmail.com** **www.genecolpines.weebly.com**

Introduction

As many other plants, pines have evolved different plastic responses to face different environmental stressors, such as light availability or insect herbivory.

Light availability may impact the ability of producing induced defenses in response to herbivory due to conflicts in the allocation of C resources in absence of photosynthesis and recently assimilated carbon compounds.

Experimental approach

We conducted a time-course greenhouse experiment with three pine species (*P. pinaster, P. radiata, P. sylvestris)*:

Plants were subject to insect herbivory by the pine weevil *Hylobius abiets,* confining one adult within each plant.

Half of the plants were subject to light deprivation during the exposition to the herbivore.

Non-volatile resin content in the stems was analyzed at different times as a measure of the plant response to insect herbivory.

Pine species: 3
Light availability: light *vs* dark
Insect herbivory: control vs. herbiv
Time course: 0, 36, 84 or 168 h

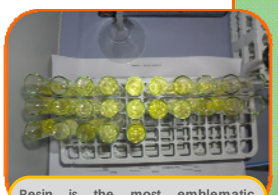
AIM

We tested whether pine tree induced chemical responses to herbivory may quantitatively depend on light availability during herbivore attack.

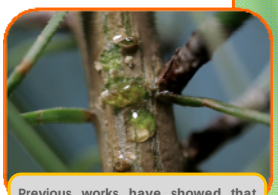
Pinus pinaster *Pinus radiata* *Pinus sylvestris*



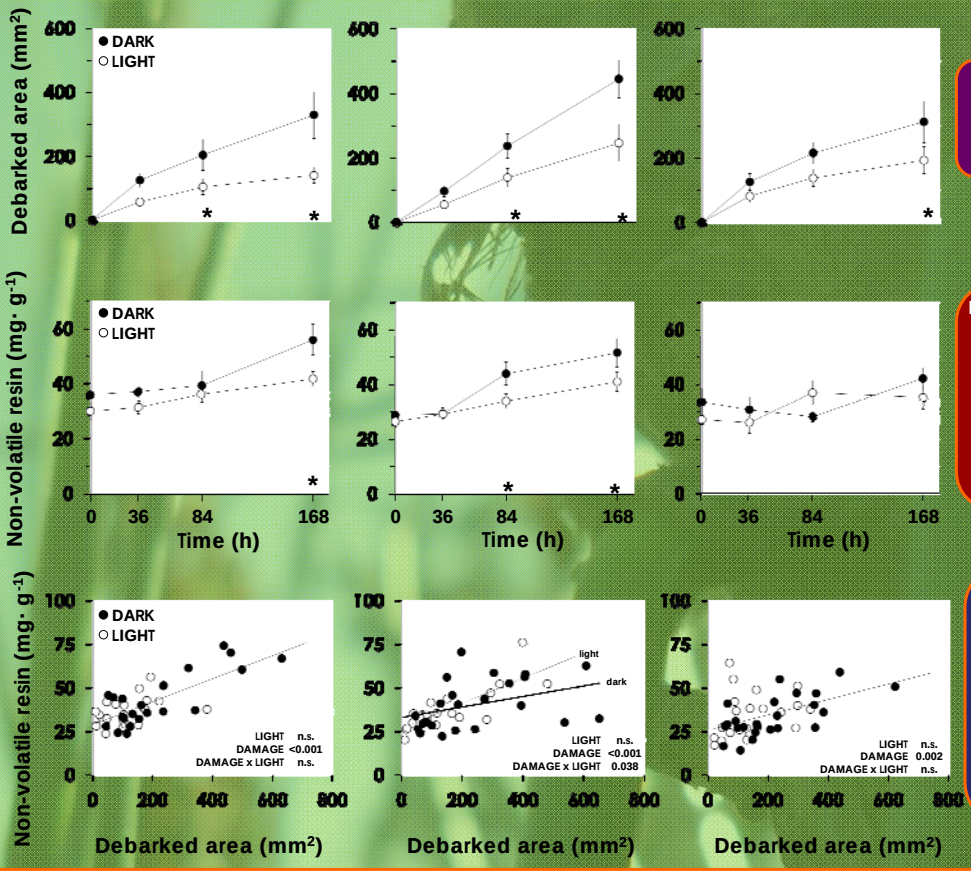
H. abietis is an important pest for the regeneration of conifer trees all around Europe. It feeds on the bark and phloem causing extensive mortalities in young seedlings.



Resin is the most emblematic defence of pine trees against herbivores and pathogens. Composed by a blend of mono, sesqui and di-terpenes, it is an effective physical barrier, toxic for many organisms and protects and seals the damaged tissues.



Previous works have showed that pine trees respond to herbivore damage by rapidly and intensely increasing the resin production [1,3].



DAMAGE by the pine weevil *H. abietis* was more intense under light deprivation for the three pine species

INDUCED CHEMICAL DEFENCES

Non-volatile resin in the stems increased after weevil damage.

Contrary to our expectation the increase was more pronounced under light deprivation.

The increase in resin production was proportional to the damage caused by the weevil.

In Radiata pine, the ANCOVA analysis indicates that resin production in response to damage was more intense (greater slope) when light was not limited.

Material and Methods

- 2-yr old juvenile pine trees were caged in plastic transparent cylinders (n = 61-64 per pine species).
- Dark treated plants were covered with an opaque plastic bag while light plants were left under natural daylight.
- Two pine weevils were confined in each plant and were left feeding for 36, 84 and 168 hours. A set of plants was analyzed before weevil exposure to estimate constitutive levels of non-volatile resin.
- Debarked area by the weevil was measured in all plants using calibrated area templates [2].
- Non-volatile resin was extracted in hexane and estimated gravimetrically [2].

CONCLUSIONS

Damage was greater in dark conditions. However, contrary to our expectations, light deprivation did not constrained the inducibility of quantitative chemical defences.

No limitation of investment in resin defences in response to damage was found in P. pinaster and P. sylvestris. However in P. radiata light deprivation appeared to decrease the production of oleoresin in relation to weevil damage.

REFERENCES
[1] Heijari et al. 2011. Feeding of large pine weevil on Scots pine stem triggers localised bark and systemic shoot emission of volatile organic compounds. Environ Exp Bot 71, 390–398.
[2] Moreira et al 2009. Defensive responses of *Pinus pinaster* seedlings to exogenous application of methyl jasmonate: Concentration effect and systemic response. Environ Exp Bot 67, 94-100.
[3] Sampedro et al. 2011. Resistance and response of *Pinus pinaster* seedlings to *Hylobius abietis* after induction with methyl jasmonate. Plant Ecol 212, 397-401.