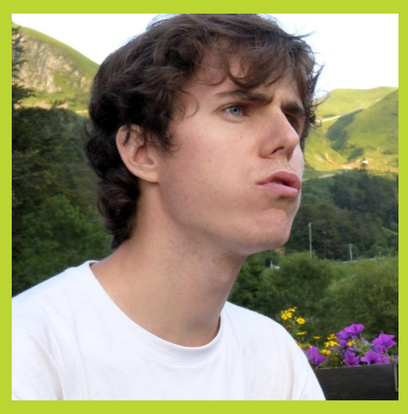
Improving the natural regulation of insect pests in field vegetables: available levers and compatibility with growers' expectations



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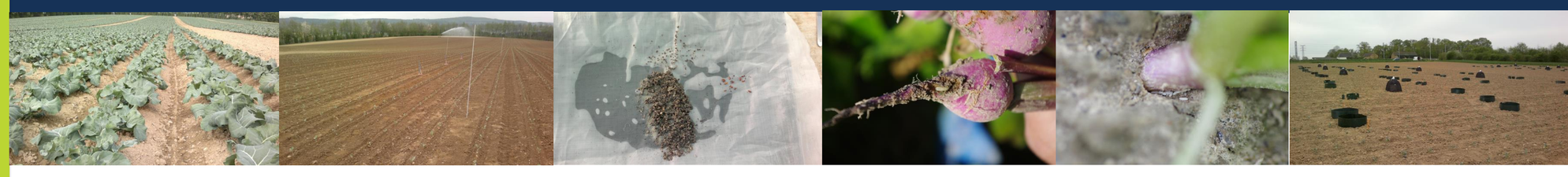


Social-economic context

There is a rising social pressure towards the **reduction of chemical inputs in agriculture**. More and more pesticides are being banned, for **environmental** (decline of untargeted organisms) and **human health reasons.**

On the other hand, the mainstream commercialization channels apply a pressure on producers to **respect visual standards** for both industry and fresh **vegetables** that do not allow for any pest development in the fields. This legitimates farmers' disposition towards preventive treatments, even when pest densities are below damage thresholds.

Scientific context

Natural regulation of insect pests is a significant ecosystem service that is provided by **biodiversity in agricultural context**. Nevertheless, consequences of this service on **crop production** are rarely considered. This is yet of great importance given that **pests may actually be innocuous** in many situations. Hence the basic assumption "fewer pests leads to fewer damages" may not be valid in a number of cases.

On another hand, most works on **conservation biological control** (i.e. favoring beneficial organisms thanks to appropriate farming practices) rely on the assumption that the abundance and diversity of natural enemies is a good predictor of regulation services. This may not be true because of intraguild predation, functional redundancy…

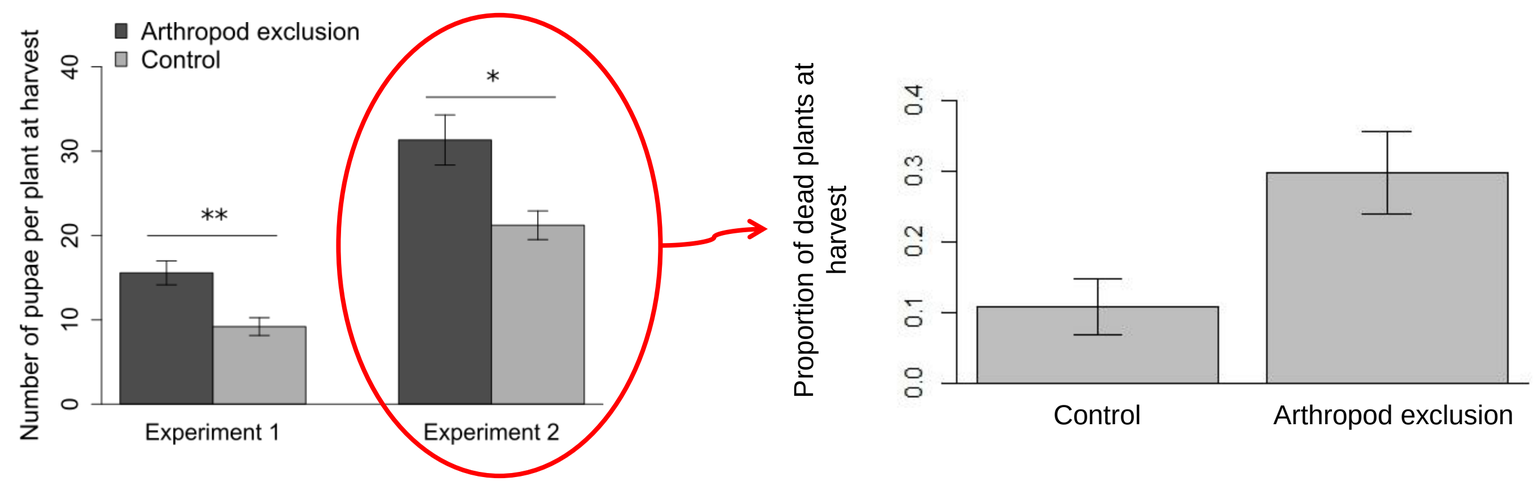
Objectives

1. Quantify the **regulation service** provided by natural enemies on **two types of pests** and on **subsequent damages to the plants**. To address this goal, we designed experiments where natural enemy populations were manipulated thanks to **exclusion devices** to occur in contrasted densities.
2. Investigate for a relationship between **pest density** and **damages** to the plants.
3. Test the efficiency of **agronomical levers** (e.g. **tillage intensity)** in improving the biological control of pests.

Work was mainly performed on **broccoli** and the main pest is the **cabbage root fly** (*Delia radicum*).

Results

1. We show significant **drops** (about 30 – 40%) in the **number of harmful cabbage root fly** due to **ground dwelling predators** (Figure below, left) in each of 4 experiments (only 2 are shown here) led in 2014, 2015 and 2016, in 2 geographical contexts. In a **highly infested context**, drop in pest density leads to **lower plant mortality** (Figure below, right). We show **similar drops for aphids** in 2 experiments due to the same natural enemies.



2. On broccolis, even the lowest pest densities seem to impact plant growth and to cause **growing delays**. Hence every suppression of pest may have significant positive **consequences on plant production**.
3. Tillage regime **did not significantly impact** the **natural regulation** of neither the cabbage root fly, nor cabbage aphids.

Perspectives

Ground dwelling predators may be fundamental for biological control as they are usually active at the beginning of pest infestation. Still, designing practices that maximize both their density **and above all pest regulation service** remains very challenging. **Intensive investigations** should focus on this matter if we are to **quickly put agroecology into practice** as highlighted in current talks.