

# Genetic and robotic technologies for pest detection in vineyards

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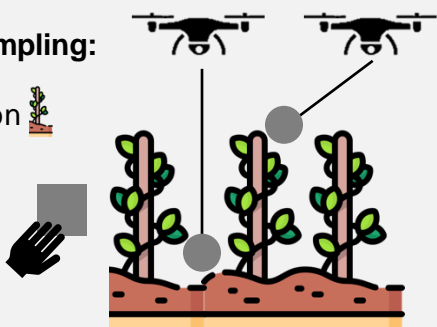
## Combining eDNA and robotics for pest detection

- Globalization and climate change have increased the risk of pest invasions and outbreaks, leading to substantial crop and economic losses
- Rapid field applicable and scalable methods are needed for large scale monitoring
- eDNA has emerged as a new tool with great potential for detecting and monitoring species
- The scalability and use of eDNA as a monitoring method is still limited
- Drones can help overcome these limitations by streamlining eDNA collection and its application

## Sampling design in vineyard

### Manual sampling:

- net
- vegetation



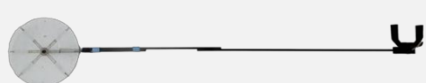
### Drone sampling:

- net
- vegetation
- grass between rows
- control meadow
- control forest



Vineyard in southern Ticino

### 3 sampling timepoints



Vineyard in southern Ticino (top left) where sampling was performed (top right) to detect *P. japonica* (bottom left), an invasive pest species. Drone samples were taken with a swabbing probe (bottom right).

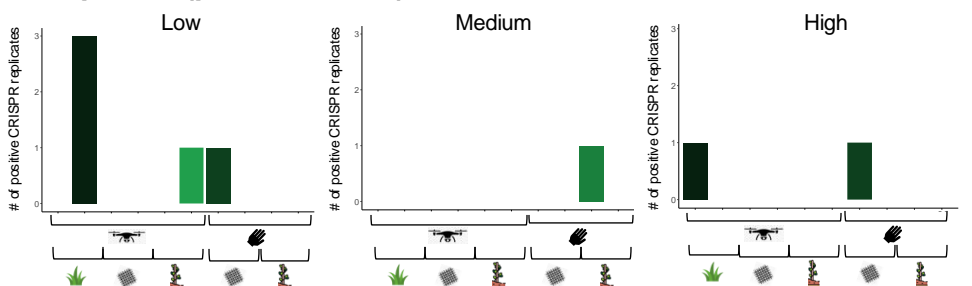
## *Popillia japonica* – a quarantine organism



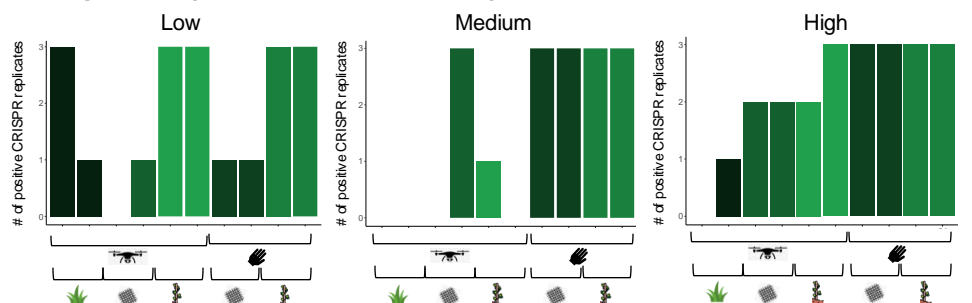
- The Japanese beetle (*Popillia japonica*) is an invasive pest species
- Classified as a quarantine organism with a reporting and control obligation in Switzerland
- First beetles found in southern Ticino in 2017
- Early detection is crucial for effective management

## Early detection through eDNA and drones

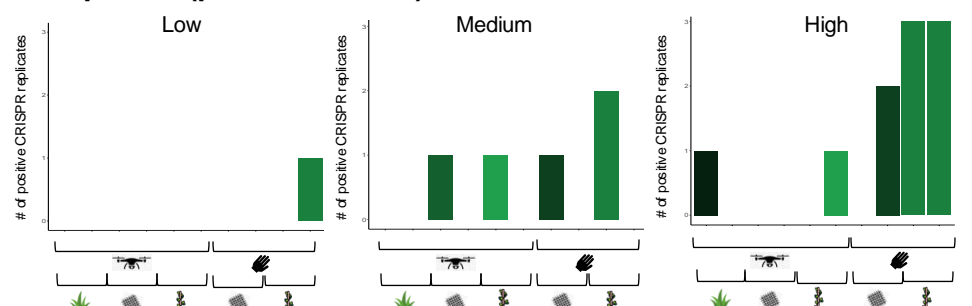
### Timepoint 1 (pre infestation)



### Timepoint 2 (maximum infestation)



### Timepoint 3 (post infestation)



➤ eDNA/drones detect *P. japonica* presence before visual sightings

## Future perspectives

By combining eDNA surveys with robotics, our approach has the potential to become a scalable solution for biomonitoring, addressing emerging threats like pests and pathogens, assessing ecosystem health (soil and pollinator diversity) and providing evidence to support sustainable practices.