



# Remote monitoring of plant-related insects using web-based camera traps

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# Taking pictures of the trap content...why?

- Too many traps to check
- Traps to be checked at difficult-to-reach places
- Traps to be checked at uncomfortable day moments (night)
- Traps to be checked many times in a day
- All the conditions above

*"I always choose a lazy person to do a difficult job because he'll find an easy way to do it"*

Bill Gates



Aim:

Developing a tool useful for checking the content of a trap



Checking the presence of a target species (or group of species) at precise moments



# Tools: Cameras

- Short-distance pictures (wide angle)
- Reasonable image quality (according to the target species)
- Settable shoot time
- Pictures sent to a website (internal modem)



Cameras and on-line pictures storage provided by Mi5 Security Ltd. (Auckland, New Zealand)

2 models:

- 1 MegaPixels img
- 3 MegaPixels img





Camera 1MP

Antenna

Solar panel

Modem (SIM card)

3.7mm Camera  
(20cm focus length)

Battery pack

# 1MP Camera features

- Low quality images (low resolution)
- Shaped for external use
- Good battery life-span (up to 1 month with 1 picture per day)
- All components separately manageable: SIM card choose by owner, SD memory card removable, able/disable modem mode (avoid sending pictures, just recorded on the memory card)
- Shoot setting through dedicated software





2012-07-26 08:28:34, Time-Lapse

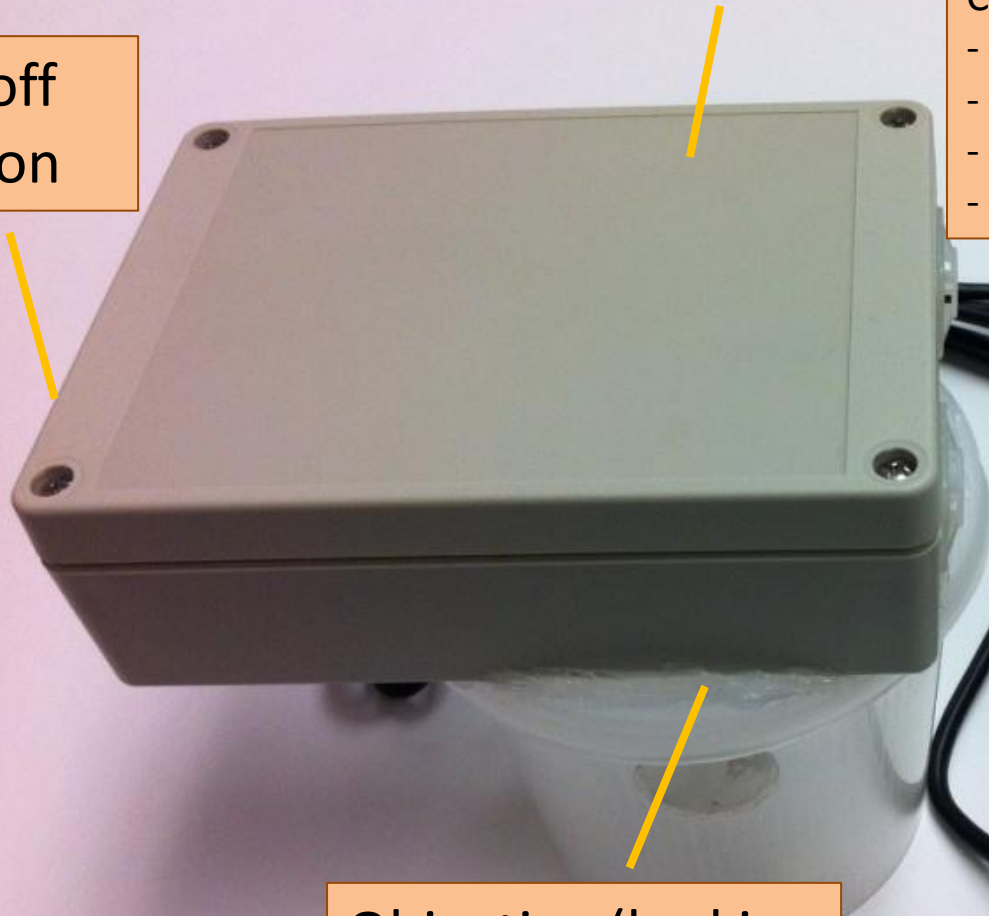




Main case

- Contains (not removable):
- Camera sensor
  - Modem and SIM card
  - Internal battery
  - Antenna

On/off button



Objective (looking downward)



External baattery pack



# 3MP Camera features

- No software to set-up
- Case specifically designed for top pictures in delta traps
- Easy to manage (only on/off button on the case)
- Low battery life (about 1 week)
- Shoot setting through SMS (only three settings per SMS)



# Setting texts (examples)

Setting timer for taking pictures

```
settimer 08.00, 12:00, 15:00
```

Information about the camera status

```
stat
```

Reboot the camera system

```
reboot confirmed yes
```

In case of more than 3  
pics per day on-line  
softwares or sms  
schedulers are available  
mainly for smart phones  
(Android or iPhone)









# Mi5 personal web page

mi5

https://www.mymi5.com/www/bin/mi5.html

**Mi5 SECURITY**

DASHBOARD BUSINESS SITES CAMERAS

Logged In: [BioCam Admin](#) | [Log Out](#)

**CAMERAS**

- ▼ BioCam - Self Reporting Camer
- ▼ PFR
- ▼ Christchurch
- ▼ Delta (0000b001)
- ▼ Lynfield (0000b004)
- ▼ Padova Uni
- ▼ Italy
- ▼ Camera (3939) - 3.7mm
- ▼ Camera (0000b003)
- ▼ Camera (0000b007)
- ▼ **Camera (0000b009)**
- ▼ MPI
- ▼ DAFF
- ▼ AgResearch Ltd

**Latest image**

**Camera (0000b009) 13:10 08/01/2013**

**RECENT EVENTS**

**List of available cameras**

**Cameras location**

Map showing the location of cameras across the world, with a callout indicating the location of Camera (0000b009) in New Zealand.

7900.0 km  
1818.2 mi

|                        | Thu 03/01/2013 | Fri 04/01/2013 | Sat 05/01/2013 | Sun 06/01/2013 | Mon 07/01/2013 | Tue 08/01/2013 | Wed 09/01/2013 |
|------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| BioCam - BPL           |                |                |                |                |                |                |                |
| BioCam - Beehive       |                |                |                |                |                |                |                |
| 19 Franklyne Rd, Otara |                |                |                |                |                |                |                |
| 6 Monde Pl, Manukau    |                |                |                |                |                |                |                |

v1.1.4

powered by **rad3** **Mi5 SECURITY**



# Camera window

The screenshot displays a web-based camera interface. The main area on the left shows a live image of a red container with a white label. A white box with the text "Image preview" is overlaid on this image. In the top right corner, a yellow circle highlights the battery status (45%) and Wi-Fi signal (57%) icons. Below this, the "Camera Details" section lists the camera ID (0000b003), site (Italy), and organization (Padova Uni). It also shows a "Settings" button. The "Current Image Details" section indicates the image was received at 12:51 on 29/12/2012 and is the 25th of 25 images. A yellow circle highlights the "Save Image" button. The "Image Search" section includes date and time filters (From 05/12/2012 12:00, To 29/12/2012 12:59) and a "Search" button. At the bottom, a timeline of image thumbnails is shown, with a blue arrow pointing to the "Latest images" section. The timeline includes timestamps from 20/12/2012 12:44 to 29/12/2012 12:51. The bottom of the screen shows a calendar view with dates from Friday, 04/01/2013 to Tuesday, 08/01/2013.

Image preview

Camera Details  
Camera Camera (0000b003)  
Image from Camera (0000b003)  
Site Italy  
Organisation Padova Uni  
A total of 160 images dating between 10:00 29/09/2012 and 12:59 29/12/2012. [Settings](#)

Current Image Details  
Received 12:51 29/12/2012  
Number 25 of 25 [Save Image](#)

Image Search  
From 05/12/2012 12:00  
To 29/12/2012 12:59  
25 to load for the selected date range [Search](#)

Latest images

20/12/2012 12:44 21/12/2012 12:46 22/12/2012 12:48 23/12/2012 12:50 24/12/2012 12:52 25/12/2012 12:51 26/12/2012 12:51 27/12/2012 12:51 28/12/2012 12:51 29/12/2012

Fri 04/01/2013 Sat 05/01/2013 Sun 06/01/2013 Mon 07/01/2013 Tue 08/01/2013



- Camera assembled with the container
- Image caught from inside the container (top image)
- Container modified: transparent structure, net as bottom



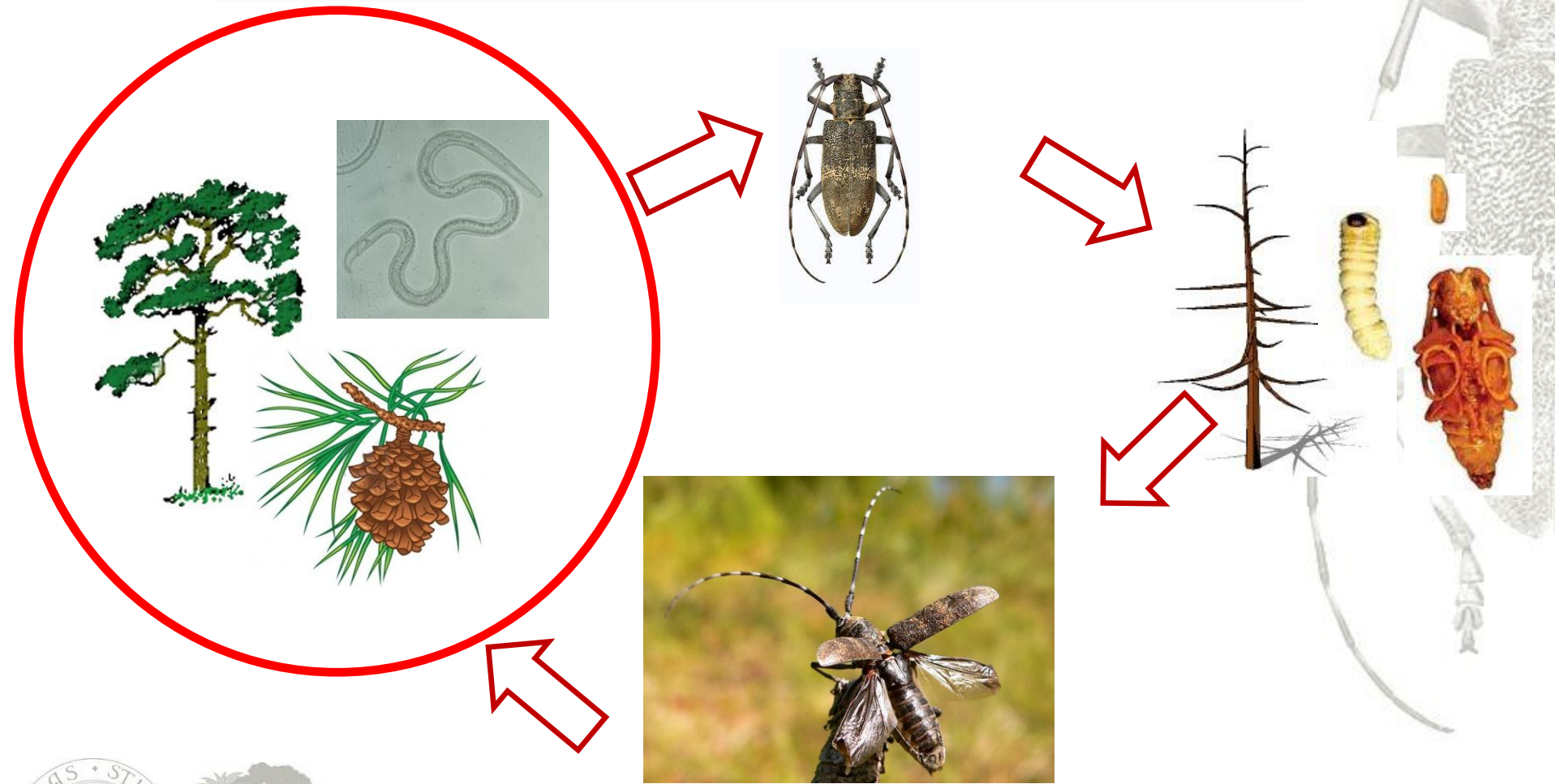


## Camera applications: 1MP





# *Monochamus galloprovincialis* life cycle



# Pine Wood Nematode *Bursaphelenchus xylophilus*



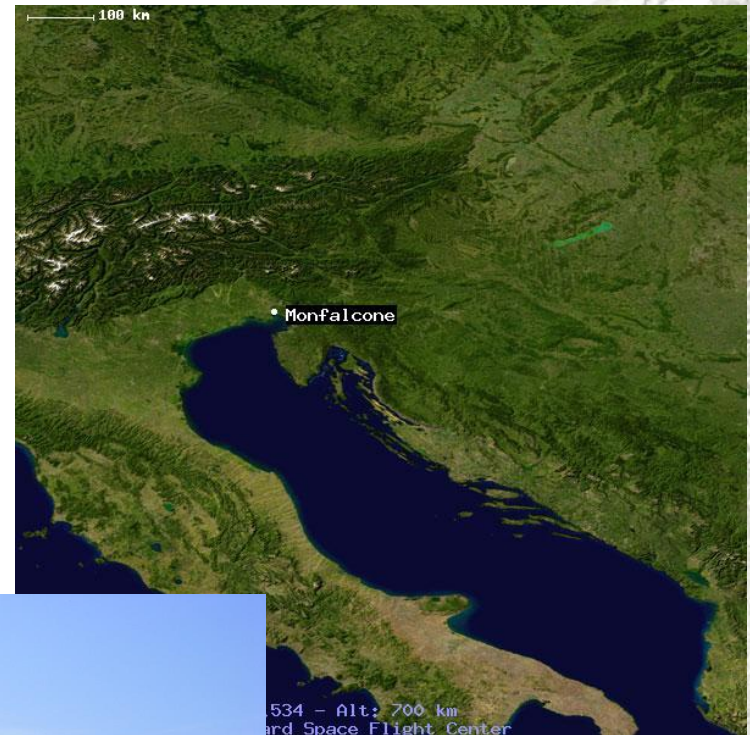
- Responsible of Pine Wilt Disease (PWD)
- Needs a vector to colonize wood
- Associated to different species of bark beetles and wood borers
- Most often associated to Longhorn beetles of the genus *Monochamus*



# Monitoring in Monfalcone Harbor (NE Italy)



August 2012 –  
verify the accuracy  
of the method





# Importance of early detection of both vectors and pathogens arriving from potentially infested areas



*Photo: D. Rassati*



*Photo: D. Rassati*



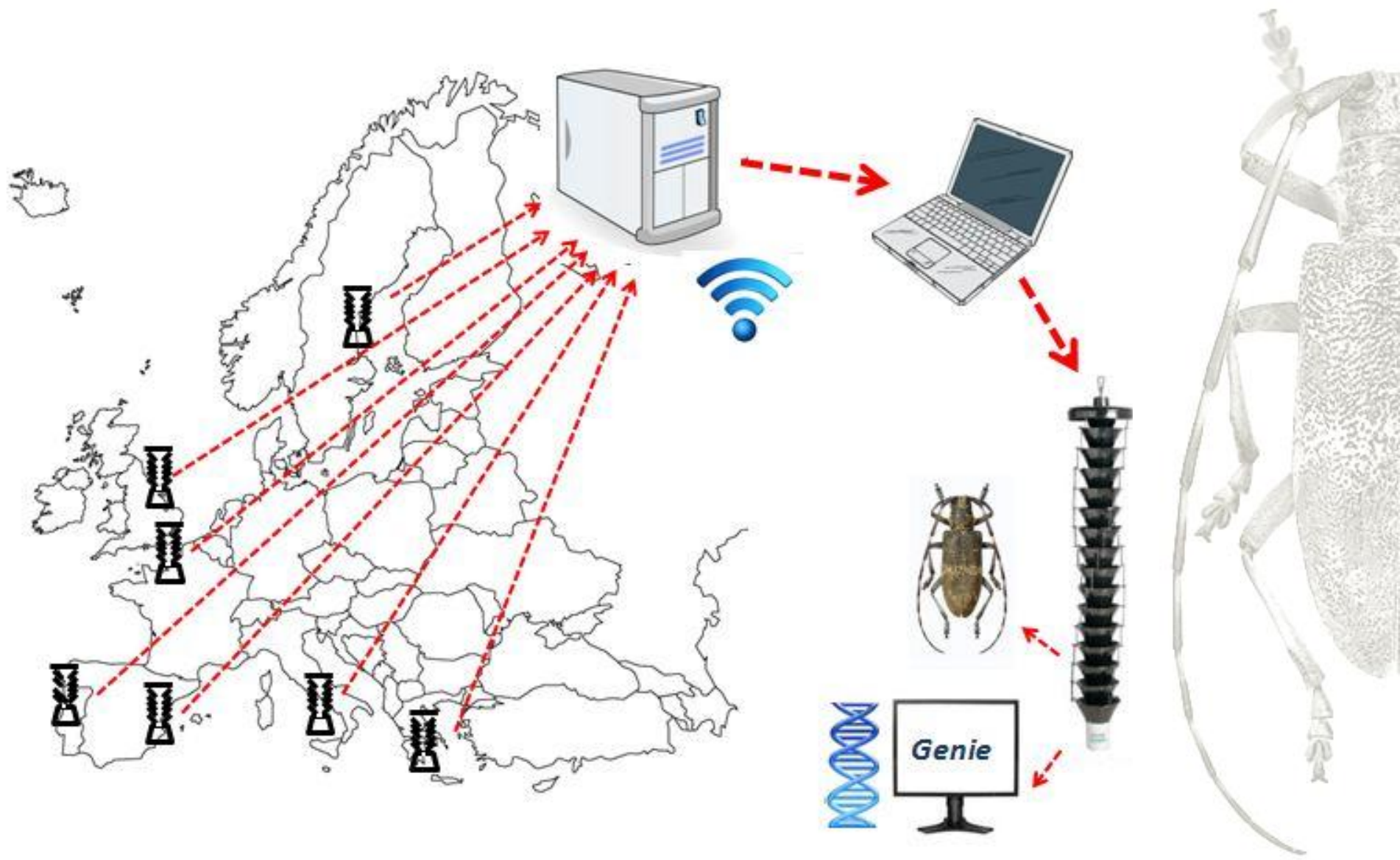
# Steps for Early Detection

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- Set monitoring in “bottle neck” areas through which the pathogen could arrive
- Traps combined with web-based cameras to check remotely the presence of target insects (vectors)
- On-site molecular confirmation of the Insect species and presence of the pathogen

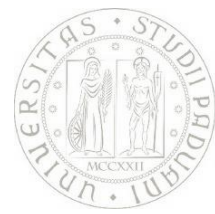














# LAMP (Loop mediated amplification)

Notomi *et al.*, 2000



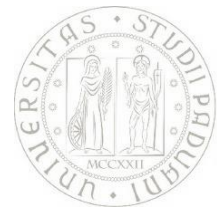
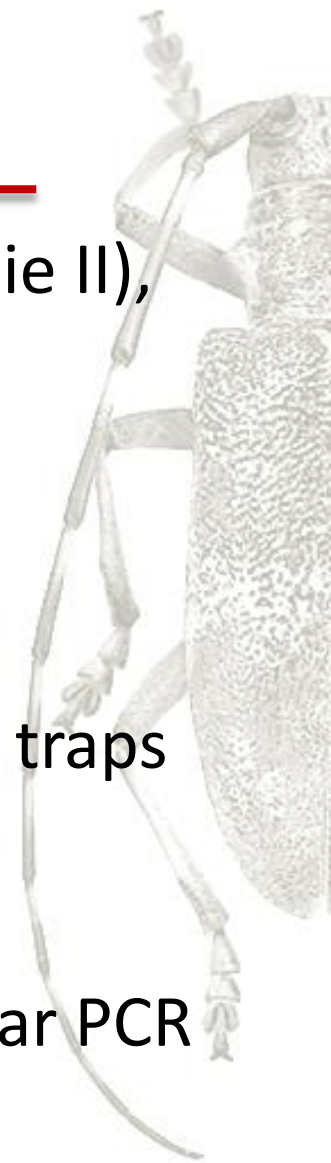
OptiGene  Genie® II



# In conclusion (1/2)

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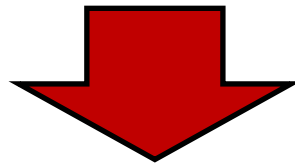
- Devices easy to set-up (cameras) and use (Genie II), little training for operators
- Vector monitoring manageable from an office
- Trap-check and molecular analysis only for the traps showing the presence of target species
- Confirmation of pathogen presence with regular PCR procedures only for positive cases



# In conclusion (2/2)

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- Field work limited to empty the traps and confirm the presence of target insect
- Constant check of pictures allows an immediate detection of the vector insect



EARLY DETECTION





*Thanks for your attention...*

