Monitoring system for spider mite damage and yellow sticky traps: PeMaTo-EuroPep Project

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Background

Proper pest monitoring is the basis of good biological control. Knowledge of the ratio of pest and beneficial insects is indispensable for determining the necessary control strategy. This Coordinated Integrated Pest Management in Europe (C-IPM) project intends to ensure a higher level of implementation of Integrated Pest Management (IPM) among European farmers.

Objectives

The main objective of this project is to develop new and innovative Environmental Monitoring System (EMS) and a Decision Support System (DSS) for tomato and pepper greenhouses, hereby increasing the sustainability and profitability of the crops. In detail the project will 1) facilitate a knowledge transfer between partners through a transnational research collaboration, 2) develop an efficient, standardized and innovative EMS for tomato and pepper crops, which will visualize the distribution of pests and beneficials throughout the greenhouse, 3) develop an advanced computer vision algorithms for accurate detection of pest and pest damage, 4) generate new insights and new biological control strategies using validated population models, 5) work out a reliable DSS which can be applied in the field using monitoring data. This can be achieved by combining the complementary expertise of the partners involved. A close interaction with the stakeholders at a transnational level will be maintained.

Project Partners

PeMaTo-EuroPep involves 5 partners from 3 different countries (The Netherlands, Belgium and Spain). The consortium consists out of fundamental and applied research organizations.

Proefcentrum Hoogstraten vzw, Belgium
(Co-ordination and management)

**Wageningen University & Research
The Netherlands (Greenhouse Horticulture)**
(Camera system, image analysis and database)

Proefstation voor de Groenteteelt, Belgium
(Trial running and dissemination)

**Instituto Andaluz de Investigación y Formación Agraria, Pesquera, Alimentaria (IFAPA), Spain
(Producción Ecológica)**
(Population model and ecological management system)

University of Antwerp, Belgium
(Population model and decision support system)

Intermediate Results

Spider mite damage detection

Tomato leaves with spider mite (*Tetranychus urticae*) damage were analysed with a hyperspectral camera system to investigate which spectral bands contain the most information for a discrimination between healthy leaf surface and damaged leaf surface (Figure 1). The results revealed that even when using colour images only, promising classification results can be achieved.

Figure 1. An example image of a tomato leave damaged by spider mite.
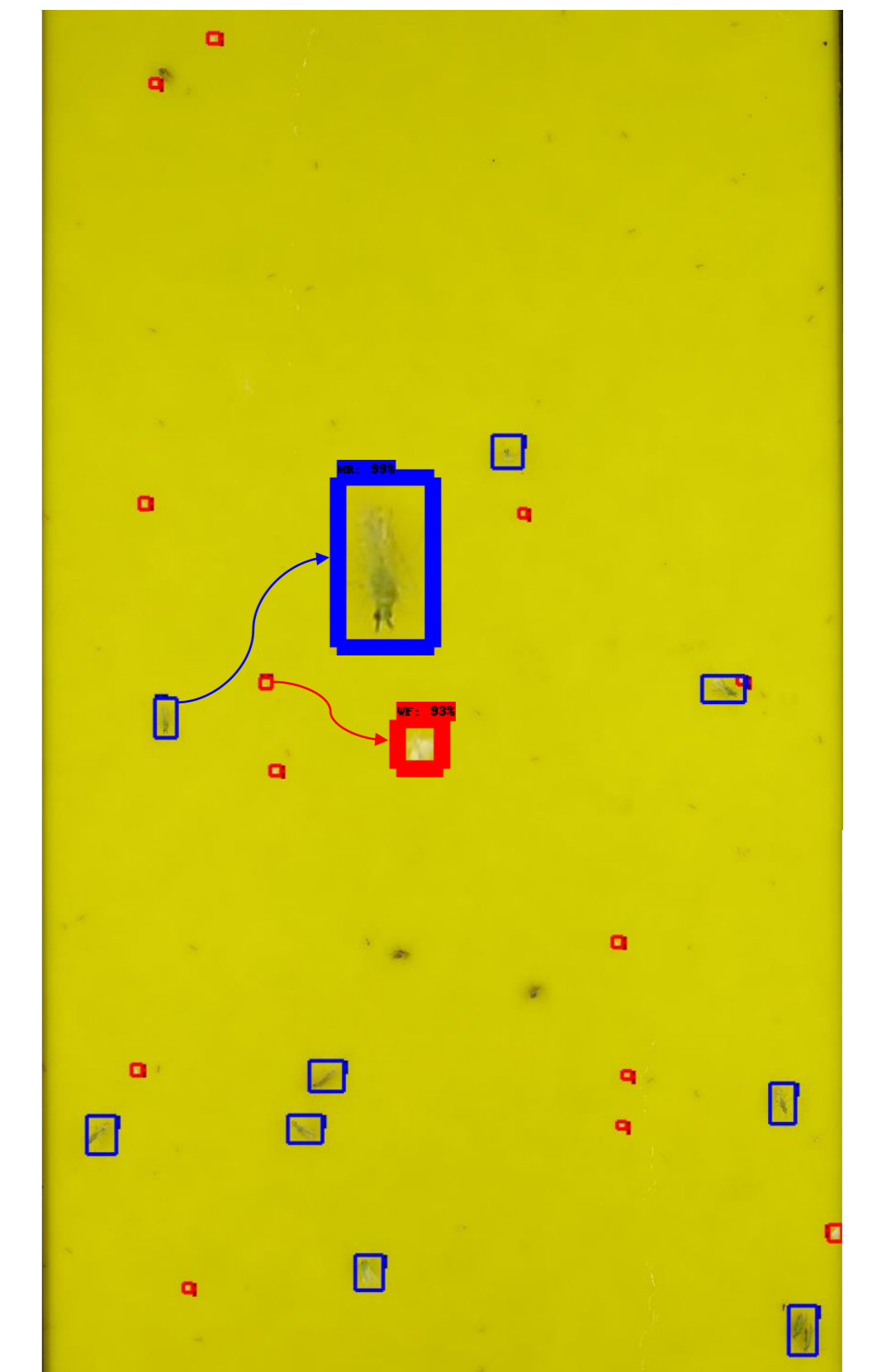

Figure 2. Yellow sticky trap with the detection results of whitefly (red squares) and macrolophus (blue squares).

Deep-learning to count whiteflies and predatory bugs

A central database between partners is established. Thousands of pictures of yellow sticky traps are stored. A deep-learning based image analysis system (Faster R-CNN) is currently under development that automatically recognizes and counts with high accuracy whiteflies (*Trialeurodes vaporariorum* and *Bemisia tabaci*) and predatory bugs (*Macrolophus pygmaeus*) on images taken of yellow sticky traps. The first preliminary results look promising (Figure 2).

Next steps

To further research the automatic detection of spider mite damage in a commercial tomato crop a mobile semi-automatic image acquisition trolley was developed by Wageningen University & Research. This trolley can carry cameras, illumination, position encoders and a data storage system to record a large amount of data in the greenhouse.

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