An automatic system for Mediterranean fruit fly monitoring

Goldshtein, E. ¹, Cohen Y. ¹, Timar, D. ², Rosenfeld, L. ¹, Grinshpon, Y. ¹, Gazit, Y. ², Hoffman, A. ¹, Mizrach, A. ¹ and Alchanatis, V. ¹

¹ Institute of Agricultural Engineering, Agricultural Research Organization (A.R.O), Volcani Center. P.O. Box 6, Bet Dagan, 50250, Israel

² The Israel Cohen Institute for Biological Control, The Plant Production & Marketing Board, Yehud-Minosson, Israel.
Israel

**Total area:**
22,072 km$^2$

**Total population:**
8.5 millions

**Fruit production:**
~50,000 ha

**Citrus production:**
~20,000 ha
• Medfly control is limited to the adult stage, which comprises only 5-10% of the fly’s population.

• Due to that, it has to be continuous (several successive bait-sprays).
Medfly Monitoring

~2,500 TML traps/20,000 ha of citrus orchards (~1 trap/ 7 ha), serviced every 10 days

This methodology is costly, cumbersome and with poor time resolution

May results in sub-optimal spraying frequency (overdue or unnecessary spraying)
Q. What is the relation between male capture in TML to the damaging potential?
Recently, there is an accelerated effort in the development of automatic traps around the world.

- Z-Trap
- López et al. 2012
- Qing et al. 2012
- Jiang et al. 2008

Hirafuji et al. 2008
Two main approaches:

Making images  
usually once a day  
EFOS, TrapView

Detect and count  
sequential data  
Jiang et al. 2008
Objectives

• To develop a sensor-based TML trap

Then

• To use the sequential data to study the effect of environmental factors and control measures (like bait spraying) on trapping dynamics

Then

• To improve Medfly control
Components of the automatic trap

The trap is composed of 4 components:

1) **Body** - a cylinder tube with entry holes
2) **Bait** - a flask with trimedlure (and DDVP)
3) **Counting module** - a glass funnel with an infra-red interruption sensing
4) **Wireless data transmission system**
Accuracy estimation: manual vs automatic count: 95 – 100%

False counting
Intruders (like ants and spiders) and mechanical/electrical malfunctions

![Graph showing trapped flies over time with manual and automatic counts compared. The graph has dates from 19.10.14 to 17.2.15 and shows peaks in the data.]
Appetizers
(Results)
Ecological data: Diurnal trapping

- Fall – winter
- Spring - Summer

Trapping rate (%)

Time (hh:mm)
Ecological data: Trapping / temp.

- Fall-Winter
- Spring Summer

**Graph:**
- Y-axis: Trapping rate (%)
- X-axis: Temp. (°C)

**Inset:**
- Distribution (%)
- Temp. (°C)
Ecological data: Trapping / daylight

0 = Twilight dawn or dusk

- Trapping rate (%)
- Irradiance (W/m²)
- Distribution (%)
Ecological data: Trapping / humidity

![Graph showing trapping rates and humidity distribution](image)

- **Trapping rate (%)**
  - Blue line: Fall-Winter
  - Red line: Spring-Summer

- **RH (%)**

- **Distribution (%)**
  - Fall-Winter
  - Spring-Summer

In the inset graph:
- X-axis: RH (%)
- Y-axis: Distribution (%)
  - Bars represent RH distribution for Fall-Winter and Spring-Summer.
What about the control?
Can daily monitoring reduce spraying actions?

• Four automatic traps were put in a grapefruit orchard from October 2014 – March 2015.

• Daily trapping data were sent to the decision makers on a daily basis

• Spraying action was affected by the daily trapping, the trapping trend, the trapping in the neighboring Steiner traps and by the temperature forecast
Daily trapping in a grapefruit orchard
Daily trapping/ rains

Mean trapped flies vs Date

Rain (mm)
Daily trapping/spraying (GF-120)

Mean trapped flies

Date

Daily trapping/spraying (GF-120)

Mean trapped flies vs Date

- Graph shows variation in mean trapped flies post-spraying events.

Note: The graph illustrates the impact of daily trapping/spraying on infestation levels.
Daily trapping/ spraying (GF-120)
Saving of spraying

The graph shows the mean trapped flies and rain (mm) over a period from 10.10.14 to 10.5.15. The x-axis represents the date, and the y-axis represents the mean trapped flies and rain (mm). The graph includes data points for each date, indicating the trends in both trap effectiveness and rainfall. The data points are marked with different symbols and colors, with orange and blue bars indicating the mean trapped flies and rain, respectively.
Thank You