

# Control of Mediterranean fruit flies in organic citrus orchards

## Problem

The Mediterranean fruit fly (medfly), *Ceratitis capitata*, is a key pest in citrus. Egg laying and larvae feeding have negative impacts on yield and export markets.

## Solution

Use sticky traps and baits to monitor and control the medfly in citrus orchards. Apply conservative and inoculative biocontrol.

## Benefits

Traps allow the detection of the medfly and the reduction of damages. Functional biodiversity (i.e., predators in the ground cover) decreases the emergence of medfly adults.

## Practical recommendation

- Apply control strategies accordingly to the life cycle of the medfly (Picture 1)<sup>1,2,3</sup>.
- Use traps composed of (i) a pheromone (i.e., trimedlure) or food attractants; (i.e., hydrolysed proteins); and (ii) a pyrethroid (e.g., deltamethrin) or Spinosad (Picture 2A).
- Make your trap! Fill a transparent bottle with a 9% water solution of protein hydrolysate (or the fertiliser sulfur ammonium) and 2% borax (Picture 2B). As an alternative, attach a vial with food attractant to a plywood panel soaked in deltamethrin (2.8%) (Picture 2C).
- Place 50-75 traps/ha, from late August (before fruits change colour) in orchards with a minimum extension of 2-3 ha or isolated ones.
- Check available biocontrol agents (Table 1) and consider the agent biology before applying (e.g., nematodes require the presence of pupating larvae in the soil)<sup>4,5,6</sup>.
- Apply cultural control methods: eliminate infestation sites and destroy infested fruits.
- Promote biodiversity (e.g., plant combinations, ground cover management, etc.) to increase predation on medfly pupae and parasitisation of larvae.
- If infestations are too high to be managed with mass trapping alone, treat with clays (kaolin at 4% concentration) before fruits change colour in plots below 3 ha. Treat plot perimeters and repeat in case of intense rainfalls.

## Applicability box

### Theme

Crop production, environment and society

### Keywords

Crop production, Pest control, Biological control, Citrus

### Context

Global, Mediterranean basin

### Application time

During the cropping season, depending on the control strategy and medfly's life cycle

### Required time

From two weeks to one year, depending on infestation rates and strategies employed

### Period of impact

One year

### Equipment

Tools depend on the employed strategy

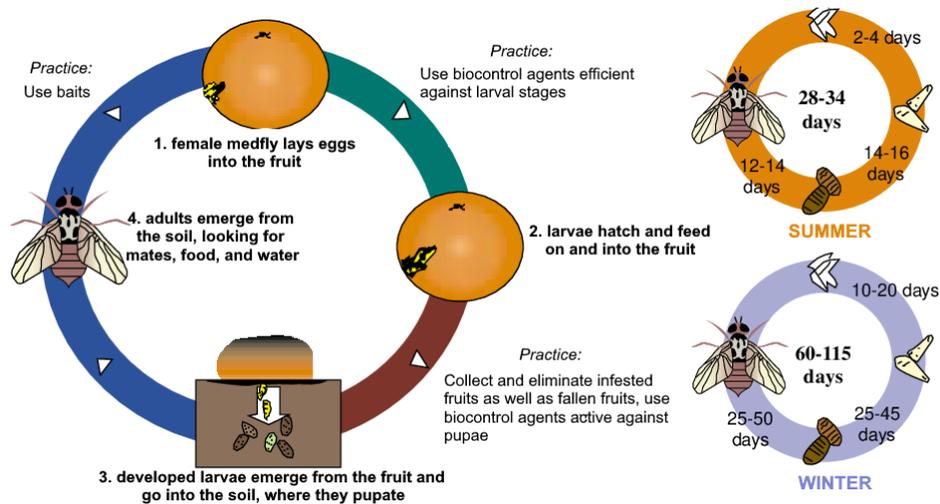
### Best in

Low-input management cropping systems

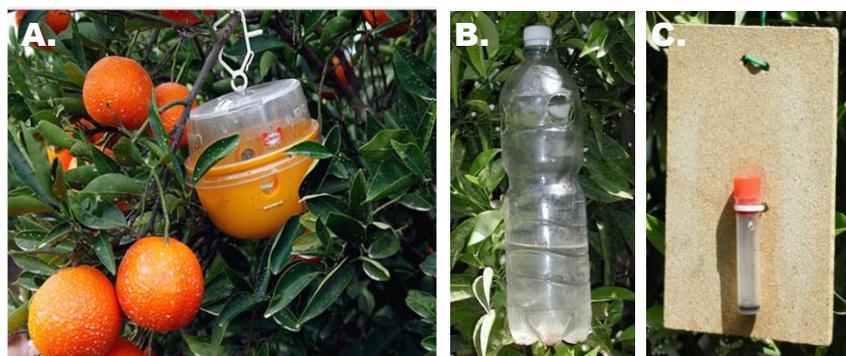


| Biological agent species              | Group      | Main fruit fly host                    |
|---------------------------------------|------------|----------------------------------------|
| ✓ <i>Diachasmimorpha longicaudata</i> | Parasitoid | <i>Ceratitis capitata</i>              |
| <i>Fopius arisanus</i>                | Parasitoid | <i>Bactrocera dorsalis</i>             |
| ✓ <i>Beauveria bassiana</i>           | Fungus     | <i>C. capitata</i>                     |
| ✓ <i>Metarhizium anisopliae</i>       | Fungus     | <i>C. capitata</i>                     |
| <i>Steinernema carpocapsae</i>        | Nematode   | <i>B. dorsalis</i> and <i>B. oleae</i> |
| ✓ <i>Metarhizium brunneum</i>         | Fungus     | <i>C. capitata</i> , <i>B. oleae</i>   |
| <i>Psytalia concolor</i>              | Parasitoid | <i>B. oleae</i>                        |
| ✓ <i>Steinernema feltiae</i>          | Nematode   | <i>C. capitata</i>                     |
| ✓ <i>Diachasmimorpha tryoni</i>       | Parasitoid | <i>C. capitata</i>                     |
| ✓ <i>Opius bellus</i>                 | Parasitoid | <i>C. capitata</i>                     |

**Table 1: Main biocontrol agents (BA) used for the control of fruit flies worldwide. Table: modified from Dias, Montoya, and Nava, 2021<sup>1</sup>. Green ticks indicate BA effective against the medfly.**



**Picture 1: Scheme showing the life cycle of the medfly and the practices that can be applied to reduce infestation rates and damages. Modified from Broughton, Sonya, and Francis de Lima<sup>2</sup>.**



**Picture 2: A) Commercial trap. B) and C) Homemade traps for the medfly. Photos: Francesco Ancona.**



## Further information

### Further reading

1. Dias, NP, Montoya, P & Nava, DE (2022) A 30-year systematic review reveals success in tephritid fruit fly biological control research *Entomologia Experimentalis et Applicata* 170: 370- 384. <https://doi.org/10.1111/eea.13157>
2. Broughton, S, & de Lima, F. (2002) Control of Mediterranean fruit fly (Medfly) in backyards.
3. Papadopoulos N.T. (2008) Mediterranean Fruit Fly, *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae). In: Capinera J.L. (eds) *Encyclopedia of Entomology*. Springer, Dordrecht. [https://doi.org/10.1007/978-1-4020-6359-6\\_1774](https://doi.org/10.1007/978-1-4020-6359-6_1774)
4. Abdel-Razek, A. S., & Abd-Elgawad, M. M. (2021). Spinosad combined with entomopathogenic nematode for biocontrol of the Mediterranean fruit fly (*Ceratitis capitata* [Wiedemann]) on citrus. *Egyptian Journal of Biological Pest Control*, 31(1), 1-5.
5. de Pedro, Luis, José Tormos, Ahlem Harbi, Fernando Ferrara, Beatriz Sabater-Muñoz, Josep D. Asís, and Francisco Beitia. "Combined use of the larvo-pupal parasitoids *Diachasmimorpha longicaudata* and *Aganaspis daci* for biological control of the medfly." *Annals of Applied Biology* 174, no. 1 (2019): 40-50.
6. Hallouti, Ayoub, Mohamed Ait Hamza, Abdelaziz Zahidi, Rachid Ait Hammou, Rachid Bouharrou, Abdellah Ait Ben Aoumar, and Hassan Boubaker. "Diversity of entomopathogenic fungi associated with Mediterranean fruit fly (*Ceratitis capitata* (Diptera: Tephritidae)) in Moroccan Argan forests and nearby area: Impact of soil factors on their distribution." *BMC ecology* 20, no. 1 (2020): 1-13.

### Weblinks

- [EU project for the management and detection of the medfly](#)
- [Useful webinars regarding management and early detection of the medfly](#)
- Check the [Organic Farm Knowledge](#) platform for more practical recommendations.

## About this practice abstract

**Publisher:** CIHEAM Bari  
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**Review:** Ambra De Simone (IFOAM Organics Europe), Vincenzo Verrastro (CIHEAM-Bari), Lauren Dietemann (FiBL)

**Permalink:** [organic-farmknowledge.org/tool/44811](https://organic-farmknowledge.org/tool/44811)

**Project name:** BIOFRUITNET- Boosting Innovation in ORGANIC FRUIT production through stronger networks

**Project website:** <https://biofruitnet.eu>

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