



# Biological control agents for the Mediterranean fruit fly

Persistent crop damage and loss caused by fruit flies (Diptera: Tephritidae) forces the reliance on chemical control methods by the fruit industry. However, social, environmental and economic consequences associated with such controls are forcing the exploration of alternative, more sustainable options. This study investigates the use of entomopathogenic nematodes (EPNs), entomopathogenic fungi (EPF) and parasitoid wasps, as biological control agents against one of the most widespread and dominant fruit flies in South Africa, the Mediterranean fruit fly (*Ceratitis capitata* (Wiedemann)).



## METHODS



### Collecting soil samples

- Orchards in fruit fly problem areas were selected, as it was expected that natural enemies would be present where high fruit fly infestations occurred.
- Soil was sieved to remove large pieces of debris and directly placed in a labelled 1L ice-cream container (A).
- A minimum of 1 kg of soil was sampled per orchard.

### Isolation of EPNs and EPF

- Susceptible insect larvae (wax moth and mealworms) were added to the soil as bait (B).
- Containers were stored in a dark growth chamber at 25 °C.
- After 5 days dead larvae were removed, surface sterilised, and placed on filter paper in a Petri dish.
- Dead larvae that showed symptoms of a potential nematode infection, such as a colour change, were placed on modified White's traps, and those with fungal growth were placed on agar plates.
- After baiting with the more susceptible bait insects, soil was baited with Medfly larvae (C).
- The method was designed to isolate any Medfly-specific EPNs or EPF that might have been present in the soil.



### Fruit sampling for parasitoid wasps

- More than 100kg of different fruit fly infested fruit was collected.
- Fruits were placed in vented ice-cream containers in an insectary to rear out the fruit flies and their parasitoids.
- Collected wasps were associated with fruit flies reared from the same fruit sample.
- Wasps were identified to the lowest taxonomic level and deposited at the Iziko South African Museum.

## RESULTS

### EPNs in local soils

#### Upington

- *Heterorhabditis bacteriophora*
- *Oscheius myriophilus*

#### Hex River Valley

- *Heterorhabditis zealandica* (D)



### EPF in local soils

#### Stellenbosch

- *Metarhizium anisopliae* complex
- *Beauverria bassiana*

#### Grabouw

- *Metarhizium anisopliae* complex
- *Purpureocillium lilacinum*



#### Upington

- *Beauverria bassiana* (E)

### Parasitoid wasps in local orchards

#### Stellenbosch

- Two species of Encyrtidae (Chalcidoidea) (F)
- Two species of Figitidae (Cynipoidea)
- One *Leptolina* species (Figitidae: Eucoilinae) (G)

#### Villiersdorp

- *Alysia manducator* (Ichneumonoidea: Braconidae: Alysinae) (H)

#### Nelspruit

- One species of Braconidae (Ichneumonoidea) (I)



## Conclusion

Local fruit producing farms contain important natural enemies such as entomopathogenic nematodes, fungi, and parasitoid wasps, which attack soil-dwelling and fruit-infesting life stages of pests like the Mediterranean fruit fly. Conservation of these biological control agents is highly beneficial and these organisms can provide an environmentally-friendly and sustainable alternatives for controlling pests.