Soil application of *Beauveria bassiana* to control *Ceratitis capitata* under ambient conditions in the field

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Introduction

The fruit fly, *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae), is a polyphagous insect and the most serious species among the tephritides. This tephritid attacks more than 250 species of fruits. C. capitata can complete several generations per year and the number of generations depending on temperature. *C. capitata* has more than 8 generations each year in Syria, and attacks especially, citrus and peach. In laboratory experiment a high mortality of *C. capitata* after a surface application of *Beauveria bassiana (*Bals.) Vuill. was observed. The objective of this study was to evaluate the virulence of *B. bassiana* to control adults of Mediterranean fruit fly *C. capitata* under semi-filed conditions.

Figure 1. Pupae of *Ceratitis capitata*

Figure 2. Larvae of *Ceratitis capitata*

Material and Methode

The insects were obtained as pupae from a laboratory breeding at 25°C, 60% RH and photoperiod 16:8 (L: D). For the experiment soil (5-7 cm high) was filled into plastic container (27 cm × 32 cm). In each container 75 pupae, two days before emergency, were spread uniformly on the soil. Then the pupae were covered with soil (4–5 cm layer). After that, 30 ml suspension of fungal spores of strain 412 (4×10^8 Spores/ml) was applied to the soil surface using a dash bottle. This application rate is in conformity with a spore density of 1.3×10^7 Spores/cm^2 on soil surface. Suspension was produced on biomalt agar in the laboratory. The germination of conidia was nearby 98%. After application the container with pupae was transferred to net-cages (45×45×63 cm) in outdoor (Fig. 3). Water and food (1:4 yeast, sucrose) were placed in the cages for the emerged flies. There were 3 replicates for the treatment and control. One month after soil application, the dead and living adults were collected and counted. The dead flies were sterilized in 0.5% NaOCl for 2 sec. and than in 70% ethanol for 2-3 sec. supplementary. After washing in sterile water, the flies were placed in humidity chambers and incubated at 20°C in darkness. Two days later the number of moulded flies was counted.

Figure 3: Net-cages (45×45×63 cm) for the experiment to control the adults of *C. capitata* by *B. bassiana* in semi field condition.

Results

1. The flies of *C. capitata* were infected pending the emergence after soil application with entomopathogenic fungus *B. bassiana* also in semi- field conditions.

2. There was a significant difference between the mortality of flies in the control and the treatment of *B. bassiana* using Tukey's honestly test ($p< 0{,}001$).

3. Demonstrably, 46% of adults of *C. capitata* died through spores of the entomopathogenic fungus *B. bassiana* at dose of $1{,}3\times10^7$ Sporen/cm^2 in semi-field conditions (Fig 5+6).

4. The most number of dead flies was infected in the treatment, about 75% of the dead flies was moulded in the treatment (Fig 6).

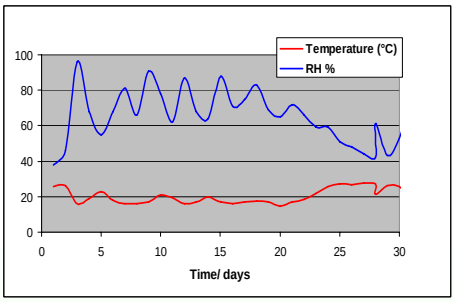

Figure 4: The outside conditions (temperature, relative humidity and rainfall) during the experiment period in summer 2008.

Figure 6: Moulded fly of *C. capitata* caused by *B. bassiana* after soil application

5. The fungal growth of *B. bassiana* on the flies' cadaver occurred rapidly and easily between 1-2 days after the incubation at 20°C in the darkness.

6. The temperature ranged between 16 and 25°C during the first five days after application and relative humidity between 55 and 95% (Fig 4).

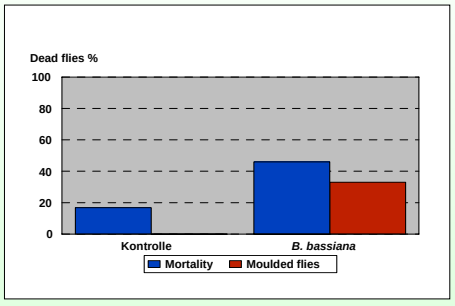

Figure 5: Mortality and moulded flies (%) of *C. capitata* after soil application of *B. bassiana* at concentration of (1,3×107 cm2) in semi field conditions

Discussion

The treatment of soil surface with conidia of *B. bassiana* controlled about 46% of the adult's and 72% of them were moulded. It means, that *B. bassiana* was responsible for the infection and following by the mortality.
The moulded flies in the treatment confirmed, that a contact occurred between the flies and the fungal spores on treated soil in the course of emergence. Following the adhered spores on the body could germinate, penetrate the body of fly and at last cause the infection.
The adhered spores of *B. bassiana* require a high humidity of 90% and temperature between 20-22°C to germinate on the body of insect. In our experiment the temperature was between 16-25°C optimal for both *C. capitata* and *B. bassiana* especially during the adhesion period of spores after application. The humidity was low at first and not optimal for germination and growth of spores. Only when humidity increased to 96% after the third day the spores germinated delayed. That was possibly the reason for the medium-mortality of flies in the experiment

The efficacy of *B. bassiana* to control *C. capitata* could be increased through higher concentration of spores and more than one application during the emergence period of the flies.