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Susceptibility of different stages of the Mediterranean fruit fly *Ceratitis capitata*, to entomopathogenic fungus *Lecanicillium muscarium*

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Abstract

This study determined the pathogenicity of *L. muscarium* to eggs, larvae and adults of *C. capitata* under laboratory conditions.
Four ml of suspension of *L. muscarium* (4×10^7 conidia/ml) was applied on sterile filter paper in Petri dishes and water for the control respectively. Eggs were placed on the infected filter paper and incubated at 20 °C. After 24 h 10 contaminated eggs were transferred on artificial diet and incubated at 25°C and 70% R.H The entomopathogenic fungus was low pathogenic to the eggs, although the differences in the mortality between the fungus (24%) and the control (8%) was significantly. To evaluate the susceptibility of the old larvae, plastic container (3.8 cm diam. × 2.8 cm high) were filled with 10 g dry soil and sprayed with 1 ml suspension (4.3×10^6 spores/cm^2) on the soil surface using a small dash bottle. On each container 10 old larvae were transferred on the treated soil in the container. Containers were incubated at 25°C and 70% R.H. *L. muscarium* reduced emergence of adult at 46% in comparison to the control with 74%. In the treatment 54% were dead but 40% of those were infected probable with *L. muscarium.* To evaluate the susceptibility of adults in plastic container (5 cm diam. × 3.5 cm high) were filled a small layer of soil and 15 ripe pupae spread uniformly on the surface. Above it 2 to 3 cm layer of soil were filled again. Three ml suspension (3×10^7conidia/ml) was spayed on the soil surface.
Incubation took place at 25° C, and 70% RH. All emerged adults were transferred daily to cages with water and dry yeast extract-sucrose. All dead flies were disinfected, placed on water agar in Petri dishes and incubated at 20°C. The fungus was pathogen to the flies. In course of experiment 65.6% of flies were dead in comparison to the control with 13.2%. 40.6% of emerged flies were moulded.
These results indicate that *L. muscarium* is pathogenic against *C. capitata*. From all developmental stages the adults are mostly susceptible against this entomopathogenic fungus

Key words: Pathogenicity, *Lecanicillium muscarium*, *Ceratitis capitata*, mortality.

Introduction

Fruit flies are the most serious pests of fruits and vegetables in the tropical and subtropical regions of the world. The Mediterranean fruit fly *Ceratitis capitata* have many generations per year (up to 8) in Syria and attacks many species of fruits. The damage to crops caused by Mediterranean fruit flies result from 1) oviposition in fruit, 2) feeding by the larvae, and 3)

decomposition of plant tissue by invading secondary microorganism (Ronald, 2007). Since several years, the integrated pest management (IPM) is used against *C. capitata* in citrus orchards of Syria. Entomopathogenic fungi are important natural control agents of many insects, including several pests (Carruthers & Hural, 1990). Therefore the Biological control using Entomopathogenic fungi could be considered as an important factor to reduce density of pest population reduction in Integrated Pest Management (IPM) programs. The objective of this study was, to evaluate the pathogenicity of entomopathogenic fungus *Lecanicillium muscarium* on eggs, larvae and adults of Mediterranean fruit fly *C. capitata* under laboratory conditions.

Materials and Methods

The different development stages of *C. capitata* were obtained from Laboratory breeding. Eggs: 4 ml of suspension (4×107 conidia/ml) was applied on sterile filter paper in Petri dishes or water for the control respectively. 10 eggs were placed on the infected filter paper and incubated at 20°C. After 24 h 10 contaminated eggs were transferred on artificial diet and incubated at 25°C and 70% R.H. There were 5 replications. Old larvae: plastic container (3.8 cm diam. × 2.8 cm high) were filled with 10 g dry soil and sprayed with 1 ml suspension on the soil surface (4.3×10^6 spores/cm^2) using a small dash bottle. On each container 10 old larvae were transferred on the treated soil. Containers were incubated at 25°C and 70% R.H. There were 5 replications.
Adults: plastic containers (5 cm diam. × 3.5 cm high) were filled with 1 cm soil and 15 ripe pupae were spread uniformly on the surface. Above it, 2 to 3 cm layer of soil were filled again. Than 3 ml suspension was sprayed on the soil surface (1×10^6 conidia/cm^2). There were 5 replications. Incubation took place at 25°C and 70% R.H. All emerged adults were transferred daily to cages with water and dry yeast extract-sucrose. All dead flies were disinfected, placed on water agar in Petri dishes and incubated at 20°C. The number of dead and mouldy individuals was counted.

Results

The entomopathogenic fungus *L. muscarium* was low pathogenic to the eggs of *C. capitata* (Figure 1). The emerged larvae from treated eggs were not infected and could develop up to the pupae.

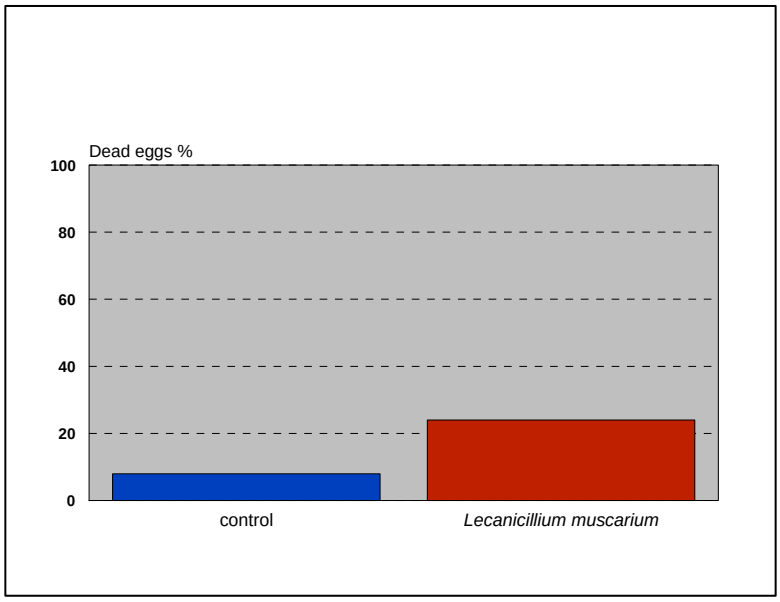

Figure 1: Mortality of eggs (%) of *C. capitata* after application of *L. muscarium* at 4×10^7 conidia/ml (25°C, 60% RH and 16:8 L: D)

The entomopathogenic fungi *L. muscarium* caused a mortality of 54% and there was a significant difference between the control and treatment (Figure 2). The Mouldiness of dead pupae was 40% and was very intensive (Figure 3).

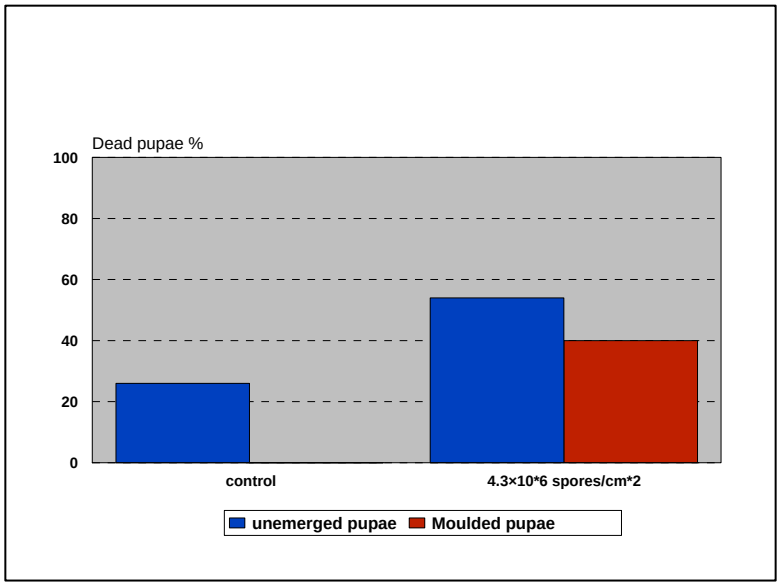

Figure 2: Dead and moulded pupae (%) of *C. capitata* after application of *L. muscarium at* 4.3×10^{6} spores/cm^{2} (25°C, 60% RH and 16:8 L: D).

Figure 3: Moulded pupae of *C. capitata* caused by *L. muscarium*

The highest mortality of all developmental stages of *C. capitata* was achieved in adults. The adults died between the 5. and 9. day after application of *L. muscarium* (Figure 4). After 14 days 62.5% of adults were died. Infected flies moulded easily and rapidly (40.6%).

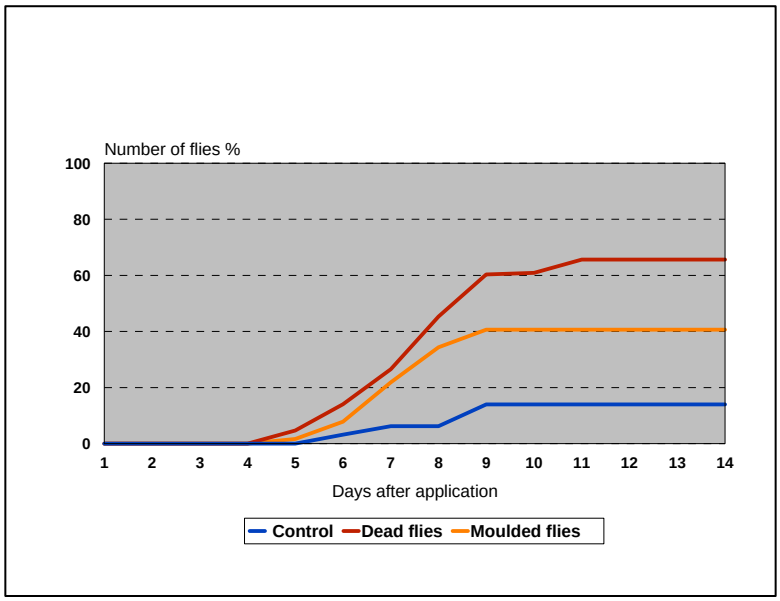

Figure 4: Dead flies (%) of *C. capitata* adults 14 days after application of *L. muscarium* at 1×10^6 spores/cm^2 (25°C, 60% RH and 16:8 L: D)

Conclusion

The entomopathogenic fungus *L muscarium* was pathogen against different stages (egg, old larvae and adult) of *Ceratitis capitata* but with different level. The adults were more susceptible to *L. muscarium*, than the old larvae. The lowest efficacy was obtained in the egg stage.
We suppose that the high mortality of adults results in the high number of adhered spores on the body of flies. During the time of the emergency there were contacts of the emerging flies and the fungal spores on treated soil. Following the adhered spores on the body resulted in infection (Ali et al. 2008)
The old larva goes into the soil (2.5 cm or more) for pupation. Therefore the contact with spores on the soil is short and only a little number of spores adhered on the larvae. Nevertheless some spores adhered successfully and could penetrate into the larvae body before or during the pupation. The infection process took place and caused mouldy pupae.
The low mortality of the eggs after direct application of fungal spores resulted in the short duration of egg stage. Therefore the first instar of larvae emerged before the spores germinated and penetrated inside the egg.
The efficiency of entomopathogenic fungi seems to be effective only for the adults of *C. capitata*. Therefore the next step is to examine a higher spore density on soil and other fungi species too.

References

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