Entomopathogenic Nematodes for biological control of *Musca domestica* L. (Insecta: Diptera: Muscidae)

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ABSTRACT

This paper presents the results of using entomopathogenic nematodes for biological control of house fly - Musca domestica L. (Insecta: Diptera: Muscidae) in field conditions. The house fly, Musca domestica Linnaeus, is a well-known cosmopolitan pest of both farm and home. This species is always found in association with humans or the activities of humans. The biological agents - entomopathogenic nematodes of the Steinernematidae and Heterorhabditidae families are pathogenic for a range of pests. These nematodes are symbiotically associated with entomopathogenic bacteria Photorhabdus and Xenorhabdus.
For the experiment we used pupae and larvae of fly (50-50) colonized 2 kg cattle dung.
For infestation of insects the nematode suspension with certain concentration - 10 000 nem/ml was prepared. Three test samples were taken, to each dung sample was added - 70, 50, 25 ml from the mentioned suspension. Appropriately, in test sample I the number of nematodes was 350 per 1 g dung, in test sample II – 250 and in test sample III – 125. As the result showed in sample I pupae and larvae mortality achieved 88.2-78%, in sample II – mortality was 43.5-40% and in test sample III – was approximately - 32.3-28.3%. The insects died mostly in the pupa stage. The analysis of the experiments conducted by us evidence that the most efficient dose of the nematode suspension applied against pupae and larvae of fly colonized on cattle dung is 350 nem/g Both spacies of entomopathogenic namatodes produced mortality of experimental insects, although the *S. feltiae* was more significant than *H. bacteriophira*.

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INTRODUCTION

The house fly, *Musca domestica Linnaeus*, is a well-known cosmopolitan pest of both farm and home. This species is always found in association with humans or the activities of humans.
The ability of the fly to develop in a vast array of patchily distributed and ephemeral organic larval substrates has enabled it to exploit virtually any area inhabited by humans and their associated animals. Adult flies pose nuisance problems to farm workers and neighboring residents. More importantly, the habit of adult flies to defecate and regurgitate on animal and human food led to the early recognition of their role as vectors of human and animal pathogens. Biological control for flies is of great importance because flies are carriers of dangerous infectious diseases (typhoid fever, tuberculosis, cholera, etc.) affecting humans and animals.
Entomopathogenic nematodes (EPNs) such as Steinernema and Heterorhabditis and their associated symbionts are virulent for fly larvae in certain substrates (e.g., cow manure mixed with soil). In laboratory studies using substrates that are favorable for nematode survival, fly larvae are highly susceptible to most of the entomogenous nematodes that have been tested. Cow manure, especially when mixed with soil or bedding, may be a more suitable habitat for nematode use. Adult flies are less susceptible to parasitism than larvae on treated filter paper but can be infected by visiting bait stations with parasites. This paper presents the results of using entomopathogenic nematodes for biological control of house fly - *Musca domestica* in field conditions. The potential of two species of entomopathogenic namatodes - *Heterorhabditis bacteriophora* and *Steinemema feltiae* were determined for virulence toward pupa and larvae of fly. Both spacies of entomopathogenic namatodes produced mortality of experimental insects, although the *S. feltiae* was more significant

METHODS AND MATERIALS

Nematodes were reared at 25^{0}C in last instar larvae of the wax moth, *Galleria mellonella,* according to procedures described by Woodring and Kaya. The infective juveniles (IJs) that emerged from cadavers were recovered using modified White traps and stored at 7^{0}C for 7-14 days before use. For the experiment we used pupae and larvae of fly (50-50) colonized 2 kg cattle dung. For infestation of insects the nematode suspension with certain concentration - 10 000 nem/ml was prepared. For experiment three test samples were taken, to each dung sample was added - 70, 50, 25 ml from the mentioned suspension. Appropriately, in test sample I the number of nematodes was 350 per 1 g dung, in test sample II – 250 and in test sample III – 125. Control treatments were received water only. Analysis of dung was checked during 5 days.

To estimate insect's mortality, they were assessed 5 days after EPN application. Presence of nematodes inside the insects was checked as indicator of nematode infection.
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RESULTS

Insect mortality was marked in both the pupa and larval stages; mortality was registered according to the Abbott method. Mortality rates of insects by used *S. feltiae* are presented in Chart 1.
As the result showed in sample I which was treated with suspension dose 350 IJs/g, pupae and larvae mortality achieved 88.2-78%, in sample II – 250 nem/g mortality was 43.5-40% and in test sample III – 125 nem/g was approximately 32.3-28.3%. The insects died mostly in the pupa stage. During dissection of the insects their body cavity and fatty tissue appeared to be infested with grown-up infective juveniles (IJs) of enthomopathogenic nematodes. Mortality rates of insects by used *H. bacteriophora* are presented in Chart 2.

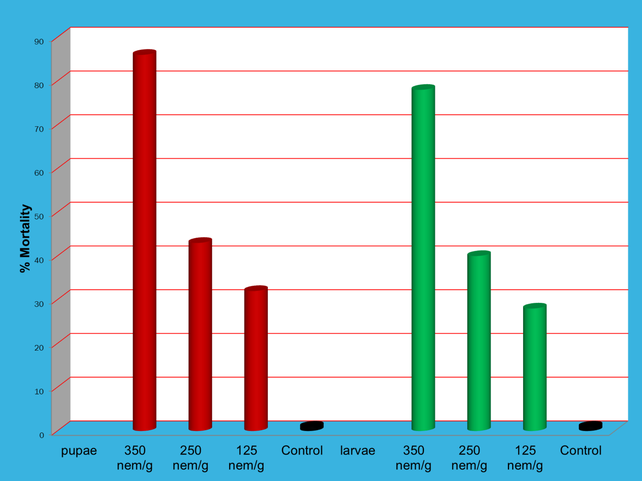

Chart 1. larval mortality % by usage of *Steinernema feltiae*

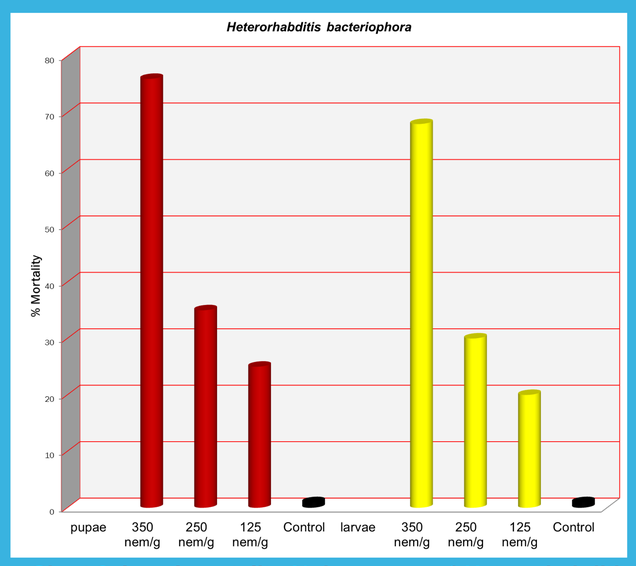

Chart 2. larval mortality % by usage of *Heterorhabditis bacteriophora*

DISCUSSION

The analysis of the experiments conducted by us evidence that the most efficient dose of the nematode suspension applied against pupae and larvae of fly colonized on cattle dung is 350 nem/g Good results were also determined by optimal climate conditions (25-31°C) and a relative humidity of the air (99%) during the trial. Both spacies of entomopathogenic namatodes produced mortality of experimental insects, although the *S. feltiae* was more significant than *H. bacteriophira.*
Thus, we can conclude that no less than 350 nem/g should be used for biological control of house fly (*Musca domestica*).

CONCLUSIONS

The authors of this paper suggest application of entomopathogens as biological control agents against a wide variety of insect pests.

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