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RESEARCH ARTICLE

# Effect of some factors on viability and bio-insecticidal potency of the entomopathogenic nematodes

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**ABSTRACT**

Improvement of entomopathogenic nematode ability to withstand the environmental extremes considered one of the issues that interested several researchers (Evans and Perry, 1976; Burman and Pye, 1980; Wharton, 1986; Kung *et al*., 1990; Gaugler, 2002; Chen and Glazer, 2005; Andalo, *et al*. 2010 and Gaugler, 2018 ). This study aims to throw the light on some factors affecting entomopathogenic nematodes such as soil texture and the storage manner of these nematodessss

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## INTRODUCTION

Pathogenicity of *Heterorhabdities bacteriophora* and *Steinernem acarpocapsae* was affected by soil texture. Infectivity of *H. bacteriophora*in sandy soil surpassed the infectivity in clay soil against cutworms *Agrotisipsilon* whereas in sandy soil0.0%,80%, 90% and 90% of cutworms were killed in comparison with0.0%, 60%, 70% and 70% in clay soil after 24, 48,72 and 96 hours, respectively.Mortality of *A.ipsilon* caused by *S.carpocabsae* ranged between 40and 60% in clay and sandy soils after 96 hr. of the treatment.

Survival of entomopathogenic nematodes differed according to the genera, time, temperature and manner of storage. *Steinernema carpocapsae* was long-lived in comparison with *Heterorhabditis bacteriophora* under same storage conditions. Highsurvival (100%) of S. *carpocapsae* and *H. bacteriophora* continued even 13 and 8 months without loss in viability post storage in bottle filled to 0.25 volume with nematode suspension (1000 ij/ ml) and incubated horizontally at 15 ºC, versus low survival times,2 weeks and one month that recorded 100% and 20% viability with the two nematode species, respectively in bottles completely filled, putted vertically and incubated at 25 ºC.

## MATERIALS AND METHODS

### *Soil texture*

One hundred and twenty pots (10 cm in diameter/each) filled with 200 cc of sandy soil and other similar pots filled with clay soil were planted with 2 *Zeamaize* seeds per each pot. After ten days of plant germination, each pot received one larva 5$^{th}$ instar of cutworm. One day later of introducing larvae forty pots of sand soil and other forty clay pots received *Heterorhabditis bacteriophora* nematodes and other forty pots of sandy soil as well as forty pots of clay received *Steinernema carpocapsae*. Each pot received 500 infective juveniles of nematodes suspended in 2 ml of water through one hole (1cm in depth) at the perimeter of the soil / pot. Rest forty pots served as check received nematode free water. Pots examined four times post treatment i.e. 1, 2, 3, 4 days. Ten pots were examined as replicates for each time

### *Storage Manner*

Entomopathogenic nematodes *Heterorhabditis bacteriophora* and *Steinernema carpocapsae* were stored soon after they are produced from cadavers at the volume of 100, 50 and25% of the plastic water bottle sizethat putted in vertical position and other in horizontal position in incubators at 10, 15 and 25ºC. Nematode suspension was at the rate of 1000 ij / ml. viability was estimated daily in the 1$^{st}$ month then monthly till the end of the experiment

## RESULTS AND DISCUSSION

Pathogenicity of *Heterorhabdities bacteriophora* and *Steinernema carpocapsae* was affected by soil texture. Nematode infectivity with *H.bacteriophora* in sandy soil surpassed the infectivity in clay soil against cutworms *Agrotisipsilon* whereas in sandy soil 0.0%,80%, 90% and 90% of cutworms were killed in comparison with 0.0%, 60%, 70% and 70% in clay soil after 24, 48,72 and 96 hours,

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respectively. Mortality of *Aipsilon* resultant the infection with *S. carpocapsae* was low than that recorded with *H. bacteriophora*. Mortality percentages of *Agrotisipsilon* caused by *Steinernema carpocapsae* in sandy soil were 0.0.,40, 60 and 60% in comparison with 0.0,0.0,40 and 40 after 24,48,72 and 96 hours, respectively (Table 1).These results may be due to the low aeration in clay than in sandy soils. Oxygen becomes a limiting factor against entomopathogenic nematodes in clay soils (Burman and Pye, 1980 and Kung *et al*. 1990). *H. bacteriophora* surpassed *S. carpocapsae* may be because the 1st is cruisers forage by moving through the soil and the last is ambusher

**Table 1** Mortality of *A. ipsilon* exposed to S. *carpocapsae* and *H. bacteriophora* in clay or sandy soils

| Nematode | Mortality % of *A. ipsilon* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Clay soil | | | | Sandy soil | | | |
| | 24hr. | 48hr. | 72hr. | 96hr. | 24hr. | 48hr. | 72hr. | 96hr. |
| *S. carpocapsae* | 0.0 e | 0.0 e | 40d | 40d | 0.0 e | 40d | 60cd | 60c |
| *H. bacteriophora* | 0.0 e | 60c | 70c | 70c | 0.0 e | 80bc | 90ab | 100a |
| Check | 0.0 e | 0.0 e | 0.0 | 0.0 | 0.0 e | 0.0 e | 0.0 e | 0.0 e |

Mortality percentages followed by the same litters insignificantly differed according to Chi square test

### *Storage Manner*

Survival of entomopathogenic nematodes differed according to the genera, time, temperature and manner of storage. *Steinernema carpocapsae* was long-lived in comparison with *Heterorhabditis bacteriophora* under same storage conditions. High survival (100%) of *S. carpocapsae* and *H.bacteriophora* continued even 13 and 8 months without loss in viability post storage in bottle filled to 0.25 volume with nematode suspension (1000 ij/ ml) and incubated horizontally at 15 ºC, versus low survival times, one month by 100 viability and 2 weeks by 20% viability that recorded with the two nematode species, respectively in bottles completely filled, putted vertically and incubated at 25 ºC. (Figures 1-4).These results may be attributed to the low aeration in completely filled and vertically posited bottles versus the high aeration in 0.25 filled and horizontally posited bottles that contained wide space of air. On the other hand 15 ºC was the optimum temperature for nematode storage. Since nematodes are aerobic organisms, low oxygen availability can reduce their survival (Evans and Perry, 1976; Wharton, 1986). *H.bacteriophora* less survived that may be due to their highest metabolic rate than *S. carpocapsae*, so it had shortest lifespan (Gaugler, 2002)

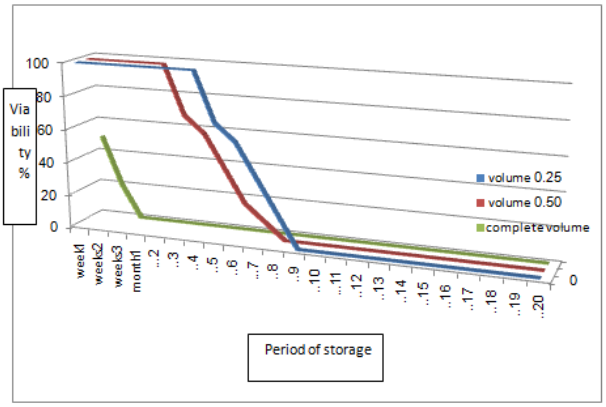


**Fig. 1** Viability of *Heterorhabditisbacteriophora* after storage at different volumes of the storage bottles at 25 ºC

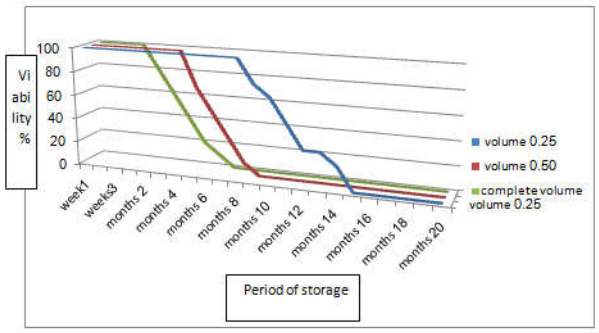


**Fig 2** Viability of *Heterorhabditisbacteriophora* after storage at different volumes of storage the bottles at 15 ºC

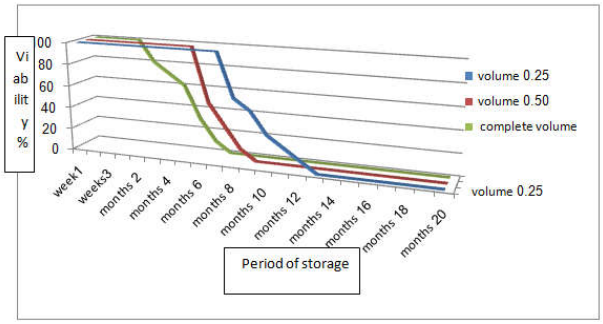


**Fig 3** Viability of *Steinernemacarpocapsae*after storage at different volumes of the storage bottles at 25 ºC

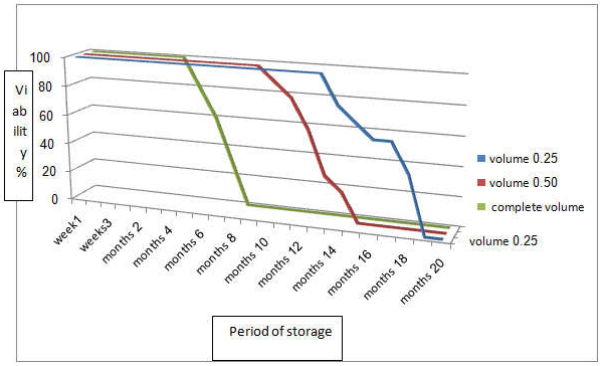


**Fig 4** Viability of *Steinernemacarpocapsae*after storage at different volumes of the storage bottles at 15 ºC

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