Comparative efficacy of entomopathogenic nematode and *Bacilus thiringiensis* against mosquitoes (Diptera: Culicidae)

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ABSTRACT

Ecological changes connected with global warming produce an essential effect on the thermal conditions of the biotopes of blood-feeding arthropods, which play a highly important role in the transmission of various pathogenic microorganisms. In recent years much attention has been given to the study of carriers of pathogenic microorganisms which cause various infections in man and animals.

The action of entomopathogenic nematode *Steinernema feltiae* and *bacterial pesticides: Bitoxibacillinae* (BTb*), Dipel* and *Thuringin*-2 have been studied.

INTRODUCTION

Mosquitoes (Diptera: Culicidae) are the most important groups of arthropods in medical and veterinary.

They act as vectors of several diseases such as malaria, yellow fever, dengue, filariasis, setariasis and encephalitis, causing serious health problems to humans.

Study has shown that in respect of feeding mosquitoes of west Georgia may be divided into three groups:

1) Species characterized by wide range of feeders, i. e. these preferring to feed on domestic ungulates, humans, and more or less birds (*An. plumbeus, An.elaviger, An. Maculipannis, An. Hurcanus, M. richiardii, A. vexans, A cinere us, A. caspius, A. geniculatus*);
2) Species which seldom bite humans, but feed mainly on domestic ungulates and poultry (*C. hortensis, C. mimeticus, C. theileri, Cs. Annilata, Cs. Setivalva*) as well as on birds and cold-blooded vertebrates (*C. territans*);
3) Species feeding in the countryside on birds and domestic ungulates (*C. p. pipiens*) and in towns on humans, birds and carnivores (*C.p. molestus, C. p. pipiens*).

The objective of this study was to evaluate the susceptibility of entomopathogenic menatode (EPN) species *Steinernema feltiae* and biological pesticide based on *Bacilus thiringiensis* against mosquitoes-*Anopheles maculipennis* and *Culex pipiens molestus* in the laboratory.

METHODS AND MATERIALS

Larval collection: In each fixed station the mosquitoes were collected from June to August 2014. The larvae were collected from the villages, 08.00 to 11.00 AM by using standard dipper (350 ml) and eye dropper then were transferred into a closed container, sent to the laboratory and placed within a few cups into cages to obtain F1 generation. In urban areas, larvae were collected from barrels and open sewage reservoirs. Rural populations came from flood plains, ditches and ground pools in forests and meadows.

Identification of mosquito using morphological characteristics. The samples were mounted and identified by systematic keys. Mosquitoes: *Anopheles maculipennis* and *Culex pipiens molestus* were counted and identified using standard identification keys of Harbach et al, Cranston et al. and Harbach. *S. feltiae* was reared in last instars larvae of the *Galleria mellonella.* In laboratory condition Bacterial insecticides *Bitoxibacillinae* (BTb*) , Dipel* and *Thuringin*-2, against mosquito larvae were tested.

RESULTS

Both species of mosquitoes (50 speciments of larval stage) were treated with suspension of 5000 nematodes/ml water (i.e. dose 100 nem/per insect) and *Bitoxibacillinae, Dipel* and *Thuringin*-2 0,1%; 0,2% and 0,5% concentration were used.

Mortality was assessed 3, 4, 5 and 6 days after treated. Effectivenes of entomopathogens was checked as indicator of infection.

The action of entomopathogenic nematode *Steinernema feltiae* and *Bitoxibacillinae Dipel* and *Thuringin*-2 are presented in the figure 1 and 2.

Anopheles maculipennis

Pesticides	Concentration	Experimental days			
		3	4	5	6
S. feltiae	5000 IJs1ml / w	-	-	15	20
BTb	0,1%	0	30	60	
	0,2%	17.2	44,5	68,5	
	0,5%	30.2	76,5	100	
Dipel	0,1%	0	18	37.0	
	0,2%	11.5	33	66	
	0,5%	22.8	59,0	85	
Turingin-2	0,1%	0	10	35.5	
	0,2%	0	19.2	45.1	
	0,5%	13.2	46	58	
Control	-	-	-	-	1

Figure 1. larval mortality % of *Anopheles maculipennis* after exposure to *S. feltiae and Bitoxibacillinae* (BTb*), Dipel* and *Thuringin*-2.

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Culex pipiens molestus

Pesticides	Concentration	Experimental days			
		3	4	5	6
S. feltiae	5000 IJs1ml / w	-	-	13	18
BTb	0,1%	0	33	59	
	0,2%	18.5	39.2	69	
	0,5%	35.2	81.1	100	
Dipel	0,1%	0	22	56.2	
	0,2%	0	40.1	63	
	0,5%	19.8	78	80.5	
Turingin-2	0,1%	0	21	32	
	0,2%	5.5	44.5	55	
	0,5%	8.2	34.5	57.5	
Control	-	-	-	-	-

Figure 2. larval mortality % of *Culex pipiens molestus* after exposure to *S. feltiae* and *Bitoxibacillinae* (BTb,*) Dipel* and *Thuringin*-2.

DISCUSSION

The results of the experiments carried out in Laboratory conditions, which are given in figures showed that the efficacy of *Bitoxibacillinae Dipel* and *Thuringin*-2 against mosquotes are evident.

The use of high concentration of bacterial pesticides (5%) gave positive results.

Insect mortality increased with the increase of concentration and exposure time.

Mortality rate of the mosquotes were 100% while EPNs infection was slight activity towards both mosquito's species.

In control tests death of the pests was not marked or the percentage index of the death-rate was in significant (0.1%).

CONCLUSIONS

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

It can be concluded that a nematode suspension of *Steinernema feltiae* slight insecticide activity toward the larvae of indicated mosquitoes. More effective of bacterial insecticides action of *Bitoxibacillinae, Dipel* and *Thuringin*-2. The insect mortality growing with increase of concentration (Anopheles maculipennis 35.5-100% and Culex pipiens molestus 32-100%). The mosquito larvae are more sensitive to the exotoxin of *Bacillus thuringiensis*

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