საქართველოს მეცნიერებათა აკადემიის მოამბე, 169, №2, 2004
BULLETIN OF THE GEORGIAN ACADEMY OF SCIENCES, 169, №2, 2004

Zoology

O. GORGADZE, SH. BARJADZE

ARTIFICIAL INVASION OF REED APHID (*Hyalopterus pruni* GOEFFR.) WITH ENTOMOPATHOGENIC NEMATODES OF *STEINERNEMA* GENUS (*STEINERNEMATIDAE*) IN LABORATORY CONDITIONS

Presented by Corr. Member of the Academy I. Eliava, September 23, 2003

ABSTRACT. **The paper presents the results of application of entomopathogenic nematodes (1:50) *Steinernema carpocapsae* strain *"agriotos", S. thesami, S. disparica and Steinernema sp.*, belonging to the *Steinernema* genus (*Steinernematidae*), against the reed aphid (*Hyalopterus pruni* Goeffr.). Treatment of aphids with nematodes turned out high-effective. Biological effectiveness of the used 4 species of nematodes made 99, 94, 88 and 96% correspondingly.** © *2004 Bull. Georg. Acad. Sci.*

Key words: necrosis, entomopathogenic nematodes, imago, nymph, strain, "agriotos".

Reed aphid (*Hyalopterus pruni* Goeffr.) is known as a strong pest of drupaceous cultures. Its colonies inhabit the young sprouts and fruits as well as lower surfaces of leaves of drupaceous plants. Method of chemical control has been applied against the above mentioned pest in Shida Kartli making hazard for the environment and human health [1,2].

Possibility of using the entomopathogenic nematodes belonging to the *Steinernema* genus for the biological control of reed aphid *Hyalopterus pruni* Goeffr. is evaluated in the present work. It should be noted that the nematodes of the mentioned group are widely used in many countries as biological preparations against the pests [3,4].

Material and methods. The aphids for the experiments were obtained from the plum-trees grown in private orchard in the village Doesi (Kaspi District, Shida Kartli). The collected aphids were transported in polyethylene pots of 0.5*l* volume covered by wire-mesh lids. Invasion of pests was performed at the laboratory of entomonematodology of the Institute of Zoology of the Georgian Academy of Sciences at the temperature 23-25^{0}C and 74-82% relative humidity of air.

Invasion of aphids was carried out on Petri dishes (100x18). Entomopathogenic nematodes have been cultivated on the worms of bee moth (*Galleria mellonella*) [4] and cabbage white (*Pieris brassicae*). Before the beginning of the experiments the number of prepared nematodes belonging to the different species was determined in 1*ml* of suspensions placed on Petri dishes. In all experiments on the average 50 individuals of nematodes were used against a single aphid. Invasion of aphids was performed using the following species of entomopathogenic nematodes: *Steinernema carpocapsae* (strain *"agriotos"*), *S. thesami, S. disparica and Steinernema sp.*, the pests of control variant were treated with tap water only. Repetition of each experiment of invasion variant was 4-fold.

The number of nematodes penetrated into aphid as a result of invasion was studied in dead aphids of different age groups. The percent of nematodes effectiveness against the pests has been established [5]. The method of complete section (slashing) was used [6]. The obtained results were treated statistically according to international methods accepted in entomonematodology [7].

Results. On the 5th day from the beginning of the experiment death rate of aphids was registered both in experimental and control variants. All of the used species of nematodes turned out high-effective (from 88 up to 99%) against the aphids (Table 1). However, among them *Steinernema carpocapsae* (99%) and *Steinernema sp.* were the most effective.

Table 1

Results of artificial invasion of aphid *Hyalopterus pruni* Goeffr. with nematodes of *Steinernema* genus

Variant	Nematode species	Number of alive aphids in the experiment (4-fold repetition)		Biological effectiveness (%)
		Before treatment	After treatment	
Experimental	*S. carp.* strain "agriotos"	155±8	2±0.2	99
Experimental	*S. thesami*	223±15	13±0.5	94
Experimental	*S. disparica*	177±10	19±0.5	88
Experimental	*Steinernema sp.*	237±5	9±0.5	96
Control	water	42±3	37±2	-

While studying the number of nematodes penetrated into aphids, it has been revealed that invasion in aphids of the IV instar and imagoes proceeds more easily than in larvae of I-III instars. For example, the number of nematodes of *Steinernema carpocapsae* strain "agriotos" made on average 2.5 individuals in pronymph of I-II instars; 6.2 in aphids of III instar; 15.6 individuals in IV intsar nymphs. The number of nematodes was significantly higher in adult aphids (77.5 individuals) (Table 2).

Table 2

Number of nematodes penetrated into the aphid (*Hyalopterus pruni* Goeffr.) as a result of artificial invasion

Nematode species	Average number of nematodes in different age aphids			
	I-II	III	IV	imago
S. carp. strain "agriotos"	2.5	6.2	15.6	77.5
S. thesami	1.5	5.1	20.8	88.5
S. disparica	1.5	5.5	13.5	71.8
Steinernema sp.	2.0	6.3	14.5	68.5

As to the number of nematodes *S. thesami, S. disparica, S. carpocapsae strain "agriotos" and Steinernema sp.*, nearly the same indices have been found as in case of nematodes of the *S. carpocapsae* strain "*agriotos*".

Analysis of experiments performed in young aphids (when using 50 nematodes per single aphid at 25^{0}C and higher temperatures) shows, that nematodes of *Steinernema* genus are capable of penetrating into aphid's organism to cause their death.

Effectiveness of nematodes against the aphids turned out to be negligible in the experiments conducted at 18^{0}C temperature. Treating aphids with nematodes *S. thesami, S. disparica and Steinernema sp.* at the mentioned temperature caused approximately 10% mortality. The nematode *S. carpocapsae* strain *"agriotos"* was completely ineffective against aphids as it failed to penetrate into the host organism.

The results of the above discussed experiment allow us to conclude that for the biological control of reed aphid and obtaining ecologically safe yield of drupaceous plants in Shida Kartli it is advisable to use the method of pests' biological control using entomopathogenic nematodes instead of application of chemicals.

Georgian Academy of Sciences
Institute of Zoology

REFERENCES

1. *A. A. Jibladze.* Aphids of Agricultural Plants of Georgia, Tbilisi, 1975, 118 p. (Georgian).
2. *R. U. Ehlers, A. Peters.* In: Biological Control - Benefits and Risks. 1995, 119-136.
3. *M. T. Smith, R. Georgis, A. P. Niczepir, R. W. Miller.* J. Nematol., 25, 1993, 78-82.
4. *G. V. Veremchuk.* Methodologic recommendations on laboratory cultivation on bee moth (Galleria mellonella) and application of entomopathogenic nematodes. L., 1986, 1-19 (Russian).
5. *W. S. Abbot, J. Econ.* Entomol., 18, 1925, 265-276.
6. *E. N. Pavlovski.* Methods of manual anatomizing of insects. M., 1957, 85(Russian).
7. *B. A. Dospekhov,* Method of field experiment (with principles of statistical treatment of results of investigations) M., 1979, 415 (Russian).

ზოოლოგია

ო. გორგაძე, შ. ბარჯაძე

ლელის ბუგრის (*Hyalopterus pruni* Goeffr.) ხელოვნური დაინვაზირება გვარ *Steinernema*-ს (*Steinernematidae*) ენტომოპათოგენური ნემატოდებით ლაბორატორიულ პირობებში

რეზიუმე. ნაშრომში განხილულია ლელის ბუგრის ბიოლოგიური კონტროლის მიზნით გვარ *Steinernema*-ს (*Steinernematidae*) ენტომოპათოგენური ნემატოდების *Steinernema carpocapsae* შტამ "*agriotos*"-ის, *S. thesami*-ის, *S. disparica*-სა და *Steinernema sp.* გამოყენების შესაძლებლობა. 23-25°C და 74-82% ჰაერის შეფარდებითი ტენიანობის პირობებში. ბუგრებზე ჩატარებულ ცდებში ნემატოდების ეფექტურობამ შესაბამისად 99, 94, 88 და 96% შეადგინა, ხოლო 18°C-ზე ნემატოდების ინვაზირების ხარისხი დაბალი (10%-მდე) იყო. ნემატოდები განსაკუთრებით ეფექტური აღმოჩნდა ბუგრის ზრდასრული ფორმებისათვის.

REFERENCES

1. *A. A. Jibladze.* Aphids of Agricultural Plants of Georgia, Tbilisi, 1975, 118 p. (Georgian).
2. *R. U. Ehlers, A. Peters.* In: Biological Control - Benefits and Risks. 1995, 119-136.
3. *M. T. Smith, R. Georgis, A. P. Niczepir, R. W. Miller.* J. Nematol., 25, 1993, 78-82.
4. *G. V. Veremchuk.* Methodologic recommendations on laboratory cultivation on bee moth (Galleria mellonella) and application of entomopathogenic nematodes. L., 1986, 1-19 (Russian).
5. *W. S. Abbot, J. Econ.* Entomol., 18, 1925, 265-276.
6. *E. N. Pavlovski.* Methods of manual anatomizing of insects. M., 1957, 85(Russian).
7. *B. A. Dospekhov,* Method of field experiment (with principles of statistical treatment of results of investigations) M., 1979, 415 (Russian).

ზოოლოგია

ო. გორგაძე, შ. ბარჯაძე

ლელის ბუგრის (*Hyalopterus pruni* Goeffr.) ხელოვნური დაინვაზირება გვარ *Steinernema*-ს (*Steinernematidae*) ენტომოპათოგენური ნემატოდებით ლაბორატორიულ პირობებში

რეზიუმე. ნაშრომში განხილულია ლელის ბუგრის ბიოლოგიური კონტროლის მიზნით გვარ *Steinernema*-ს (*Steinernematidae*) ენტომოპათოგენური ნემატოდების *Steinernema carpocapsae* შტამ "*agriotos*"-ის, *S. thesami*-ის, *S. disparica*-სა და *Steinernema sp.* გამოყენების შესაძლებლობა. 23-25°C და 74-82% ჰაერის შეფარდებითი ტენიანობის პირობებში. ბუგრებზე ჩატარებულ ცდებში ნემატოდების ეფექტურობამ შესაბამისად 99, 94, 88 და 96% შეადგინა, ხოლო 18°C-ზე ნემატოდების ინვაზირების ხარისხი დაბალი (10%-მდე) იყო. ნემატოდები განსაკუთრებით ეფექტური აღმოჩნდა ბუგრის ზრდასრული ფორმებისათვის.