Entomology

Prospects of Insect Parasite Nematodes Research Development in Georgia

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ABSTRACT. At present the main dangerous pest insects to vegetable and technical cultures in closed and open agriculture are: the Colorado potato beetle - *Leptinotarsa decemlineata* and the greenhouse whitefly, *Trialeurodes vaporariorum.* The introduced nematodes (Israel) *Steinernema feltiae* and *Heterorhabditis bacteriophora* HP88 (1000 IJs/ml) have been used. As the result of investigations, the nematode *S. feltiae* shows high biological efficacy (98%) as compared to HP (79%). *© 2008 Bull. Georg. Natl. Acad. Sci.*

Key words: *Leptinotarsa decemlineata, Trialeurodes vaporariorum, Steinernema feltiae, Heterorhabditis bacteriophora.*

Georgia, a relatively small mountainous country in the Caucasus, has a variety of landscape zones and is rich in flora and fauna. It has a well-developed forestry, horticulture, viticulture, vegetable gardening, citrus, tea growing industry and subtropical crops. The damage caused by pest insects in agriculture, urban horticulture and forestry of Georgia has increased greatly. Hence it is necessary to take protective measures against them.

The most important damage causing pests in Georgia today are: the fall webworm - *Hypantria cunea*, the gypsy moth - *Ocneria dispar,* the grape berry moth - *Lobesia botrana*, geometridae' complex, the Colorado potato beetle - *Leptinotarsa decemlineata*, the greenhouse whitefly - *Trialeurodes vaporariorum,* locusts, and others have been recorded. These pests are distributed almost on the whole territory of Georgia and do damage to the national economy. Therefore it is necessary to protect plants from pest insects by environmentally safe means, such as biological control agents.

Entomopathogenic nematodes (EPNs) from the *Steinernematidae* and *Heterorhabditidae* families are effective biological control agents because of the easy production of culture, high lethality against key pests, and safety [1].

At present EPN research is being conducted under the research agreement between the Agricultural Research Organization in Israel and the L. Kanchaveli Institute of Plant Protection, Georgia, supported by the United States Agency for International Development (USAID-Israel) CDR Program.

The goal of the present study was to determine the efficacy of EPNs against various important insect pests in Georgia.

In the present study the important insect pests for vegetable cultures - the Colorado potato beetle, *L. decemlineata* and the greenhouse whitefly, *T. vaporariorum* were tested. Both pests were obtained from infested plants. The larvae of potato beetle were collected from potato plants (Tserovani, Mtskheta district) and transferred to laboratory for experiments. The field tests were conducted in the same place on potato plants, where the number of beetles was higher than the economic threshold of harmfulness. Whiteflies were collected from tomato leaves populated by the greenhouse

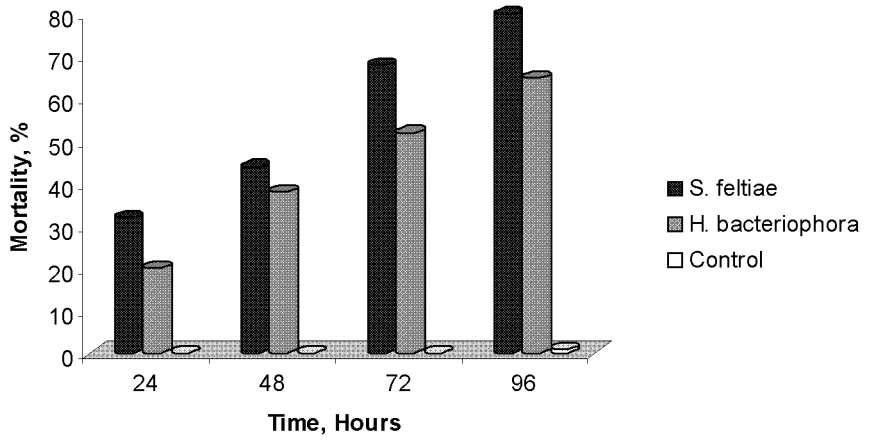

Fig. 1. Effect of nematodes *S. feltiae* and *H. bacteriophora* against Colorado potato beetle, *Leptinotarsa decemlineata* on potato plants in field conditions

of I.Lomouri Institute of Agriculture, for laboratory experiments. In the same greenhouse small scale tests were conducted.

The EPNs *S. feltiae* (Strain SFG) and *H. bacteriophora* (Strain HP88). The first strain was isolated from the soil of a citrus orchard in the Negev, a semiarid region in Israel [2]. The latter is a lab culture. The second strain was received from the USA in Israel. The nematodes were reared at 25°C in the last-instars of the greater wax moth *Galleria mellonella* (L.), according to the method of Kaya and Stock [3]. After storage at 5-6°C for 1 week, they were acclimatized at 21-23°C for 24h before use in the different assays [3].

Colorado potato beetle

Larvae of Colorado potato beetle (II-III instars) were collected from potato plants (Tserovani) and were transferred to laboratory. The experiments were conducted at temperature 26° and RH 78%. The larvae of the beetle were allocated in the Petri dishes padded with moist filter paper (10 individuals /dish). Infective juveniles (IJs) of SFG and HP88 strain were applied onto the filer paper at rate of 1500 ml IJs in water suspension.

The field experiments on the infectivity of the Colorado potato beetle were conducted in potato plants (12 young plants, temperature 22°, RH, 85%) where plants were populated by II-III instars of pest larvae. The nematode suspensions of SFG and HP (100 ml, concentration 1500 nematode/ml), were used for spraying.

Tomato plant leaves populated by the greenhouse whitefly, which were collected in greenhouse and transferred to laboratory into 9 cm diam. Petri dishes padded by moist filter paper. Each dish contained 80 individual III instars larvae, which were allocated. II-III instars infective juveniles of SFG and HP88, and these strains were applied onto the filter paper at the rate of 1000 IJs /ml per dish in water suspension. Sixteen young tomato plants in greenhouse, about the age of one month and without fruit, infected by whiteflies, were selected. Before treatment of the tomato leaves the live whitefly larvae were counted. Then, IJs of the SFG strain were sprayed with 50 ml nematode suspension of 1000 IJs/ml, at the temperature 26°C and RH 63%.

In both experiments described above the determination of insect mortality was conducted every 24 h, for a

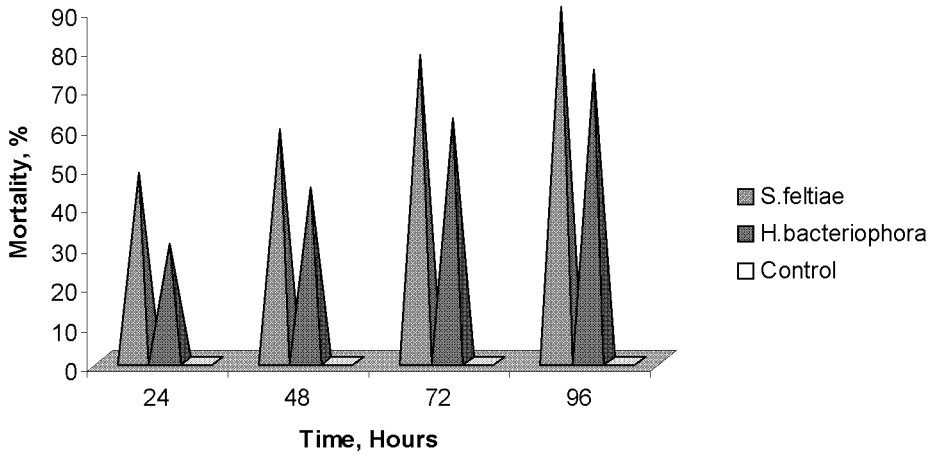

Fig. 2. Effect of nematodes *S. feltiae* and *H. bacteriophora* to *T. vaporariorum* on *F. globosa* plants in laboratory conditions

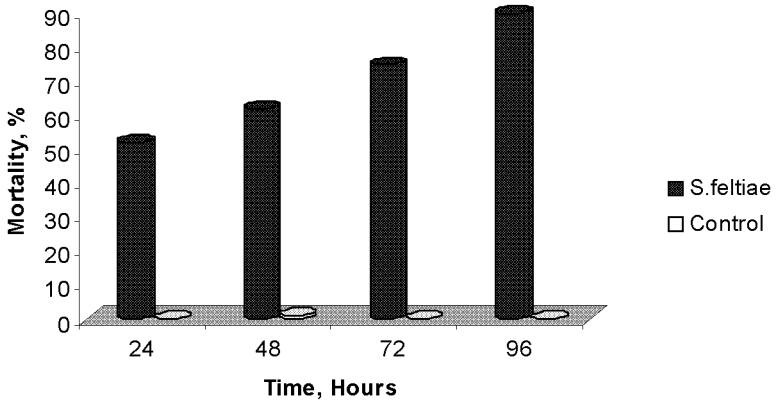

Fig. 3. Effect of nematode *S. feltiae* and *T. vaporariorum* on tomato plants in greenhouse conditions

96 h period. Each treatment consisted of three replicates. The nematode effect was evaluated by calculating the mortality, using Abbot Formula [5].

The effect of *S. feltiae* (Strain SFG) and *H. bacteriophora* (Strain HP88) on larvae of Colorado potato beetle *L. decemlineata* is shown in Fig. 1. Over 96 h insect mortality gradually increased from 32% to 80% with the SFG strain. The effect of the HP88 strain was somewhat lower than that of SFG, from 20% to 65% (Fig. 1). No mortality was recorded in the non-treated control.

The effect of these EPN strains against the whitefly *T. vaporariorum* in laboratory and greenhouse conditions are given in Figs. 2, 3.

In both laboratory and greenhouse tests the SFG strain resulted in 90% mortality of whitefly larvae. The effect of the HP88 strain was lower than that of SFG in the lab and was not tested in the greenhouse.

The results suggest that it is reasonable to continue investigations on *S.feltiae* effectiveness in large-scale experiments, because this biological agent is considered to be a prospective means of biological pest control in Georgia.

The development of native industry based on biological methods of plant protection is one of the important requirements of the present, which will preserve the biodiversity by obtaining pure products and will promote the rise of the national economy.

ენტომოლოგია

მწერების პარაზიტული ნემატოდების კვლევის განვითარების პერსპექტივები საქართველოში

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მთავარ საშიშ მავნებლებს სოფლის მეურნეობის ბოსტნეული და ტექნიკური კულტურებისათვის, როგორც ღია, ასევე დახურულ გრუნტში, წარმოადგენენ კოლორადოს კარტოფილის ხოჭო - Leptinotarsa decemlineata და სათბურის ფრთათეთრა - Trialeurodes vaporariorum. მათ წინააღმდეგ ინტროდუცირებული ნემატოდები

(ისრაელი) - Steinernema feltiae და Heterorhabditis bacteriophora HP88 (1000 IJs/მლ) იყო გამოყენებული. როგორც კვლევის შედეგიდან ჩანს, *S. feltiae*-ს ბიოლოგიური ეფექტურობა მაღალია (98%), H. bacteriophora-თან შედარებით (79%).

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