LYSIPHLEBUS FABARUM ROLE IN REDUCING THE NUMBER OF APHIDS IN VEGETABLES PLANTS

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Abstract. *One of the parasitic species for the aphids present on tomato plants are the braconid wasp called Lysiphlebus fabarum (Braconidae: Hymenoptera: Insecta). The purpose of this scientific paper is to determine whether these wasps can be a way of reducing the population aphids. Tomato plants typically attract many harmful aphid species. It is known that aphids are the most common dangerous species with a high number of generations, and generally difficult to control. Observations were conducted under laboratory conditions in Uzbekistan. The study of the efficacy of Lysiphlebus fabarum on aphids shows that parasite entomophagus can provide a reduction in the number of aphids in tomatoes, even at a ratio of 1:20, their biological efficiency being approximately 50%, and in the ratio of 1: 5 and 1: 10 is about 90%.*

Keywords*: biological control, aphids, parasitic species, Lysiphlebus fabarum.*

INTRODUCTION

One of the principles of the use of parasites and predators in biological control is the seasonal colonization method, based on laboratory reproduction and crop release.

In recent years, there have been numerous worldwide attempts at breeding and the effective application of parasitic wasps in the biological control of aphids (GRENIER S., LIU W. H., 1990, Жумаев, 2016; Жумаев, 2017).

The literature data provided is quite inconsistent and does not provide the necessary basis for each country where this parasite is present (АДАШКЕВИЧ AND ШИЙКО, 1983; ДАВЛЕТШИНА AND ГОМОЛИЦКАЯ, 1980; ДОСПЕХОВ Б.А, 1985, ЖУМАЕВ Р. А, 2016).

The first Eastern European studies on the growth of these braconid parasitic wasps were made more than 40 years ago in Moldova.

Reproduction and use of the parasite in reducing harmful activities of aphids in Uzbekistan is practically not present at this time. There are only studies conducted by A. G. Davletshinoy, E Gomuliki in years of around ´80, on the study of the parasite *Lysiphlebus fabarum* and its reproduction in the laboratory and only on cotton aphids.

Our studies on the reproduction of aphids and their parasites in the laboratory allow us to come to a conclusion on the possibility of growing and applying two types of wasps against the most dangerous species of alfalfa in the second year, pumpkin, tomatoes and sweet peppers.

MATERIAL AND METHODS

The process of evaluating the interaction and effectiveness of biological control of parasitic species for aphids was performed under laboratory conditions and phased in, as follows: plant cultivation, growth of aphid species and parasitic species.

The research that is the subject of this paper was conducted in Tashkent, Uzbekistan, more precisely at Tashkent Agrarian State University (Figure 1). Observations were made both in field conditions (from which parasites and parasites were collected) and laboratory (where

interactions between aphids and parasites were carried out, as well as their growth, the growth of host plants).

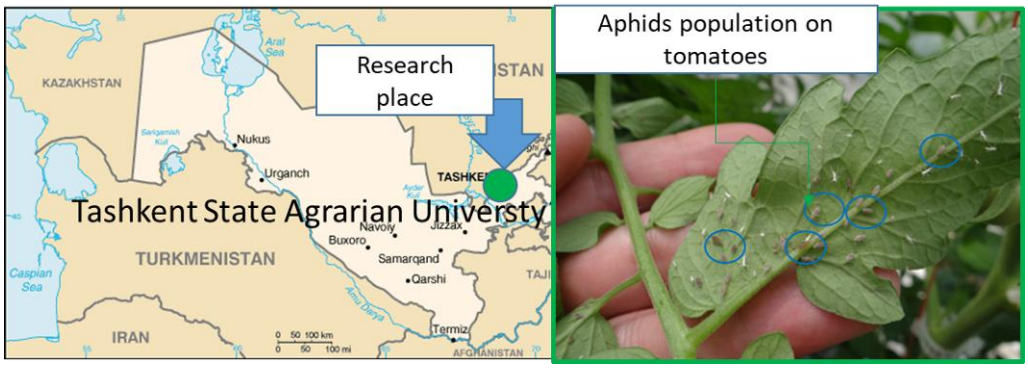

Figure 1. Research places in both areas laboratory and fields from Tashkent, Uzbekistan (the map is taken from the public domain); the population level of the aphid's colonies observed on tomatoes plants before biological control

Plants cultivation in laboratory. For the cultivation of the favorite plants, the most apt choices were chosen, namely, alfalfa in the second year, pumpkin, tomatoes and sweet peppers. The plants were grown in ceramic pots. Alfalfa was transplanted from natural conditions into ceramic pots, and the others were grown from planting of saplings (peppers and tomatoes) and pumpkin seeds. The optimal growth and development conditions for these plants were +21.0, + 25.0°C and a relative humidity of 65-75% at 12-13 hours of photoperiod.

Harvesting of aphids. When the pepper plants had 6-8 true leaves (Bulgarian varieties), tomatoes had 4-6 levels with leaves, the pumpkins had about 3-5 leaves and 8-10 cm alfalfa, and an average of 25-30 aphids per plant was introduced. The following types of aphids were located: *Aphis craccivora* and *Acyrtosiphon pisum* on tomatoes and alfalfa, *Myzodes persicae* on pepper and *Aphis gossypii* on pumpkin.

Harvesting of aphids (mostly on tomatoes) in winter was made from the protected environment (greenhouses). Reproduction of the aphids took place in a separate room.

Interaction aphid- parasite. A few days later, when the number of aphids reached 100-200 exemplars on pottery boxes, the plants were transferred to another room where they were placed under isolation.

Adults of the *Trioxys asiaticus* and *Lysiphlebus fabarum* parasites were then introduced. Parasites, prior to placement, were fed a 20% sugar syrup in glass jars.

Aphids (in number of 10) were placed to one parasite, host ratio: aphid = 1:10.

Efficacy study. After 2-3 days, the insulator was removed. For 8-10 days after infection of part of the plants with mummified aphid's colonies, these were cut and placed in glass jars.

In these experiments, from a plant has resulted from 80 to 110 mummies to a number of aphids of 150-200 exemplars.

In winter, for the purpose of keeping the parasitoid wasps in the laboratory and using them, the alfalfa is best suited. In the second year of growth, this plant grows rapidly within 4-5 days of planting, and so can be a very good host for aphids and these for parasite organisms.

The results of the study, as static treatment, were performed by Armor's method (1983), and biological efficiency was determined by the Abbott formula (1925).

The experiment was carried out at the Experimental Plant Biological Research Center and Repeat Experiment Station (TSAU) five times, biological efficiency was calculated according to the Abbot formula (1925), which is the next one:

$$Бэ = \frac{100(Ab - Ba)}{Ab}$$

To which:

A -in control, the number of pests after treatment;

B - in experience, the number of pests before treatment;

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A - in control, the number of pests before treatment.

RESULTS AND DISCUSSION

Important conditions for obtaining the high biological effect of braconid species (parasitic wasps) are considered the following: resistant organisms, with high viability, environmental factors conducive to development, availability of food (aphids), availability and optimal choice of host plants with a good ratio aphids: parasite.

In this respect, the effect of different perspectives on the behavior of the parasite in the control of aphids in crops, especially tomatoes, has been studied (Figure 2).

The use of parasites against aphids-pest from crops is done in two ways: the first method of arranging mummies on plant, the second placed of adult parasites raised in the laboratory. The parasites were harvested in certain quantities in the test tubes and after these were placed on plants (leaves).

Three variants were tested:

a. 1 parasite to 5 aphids

b. 1 parasite to 10 aphids

c. 1 parasite to 20 aphids

All of these variants respected the parasite reports: host = 1: 5, 1:10 and 1:20. Before the parasites were released, the number of plant aphids was considered.

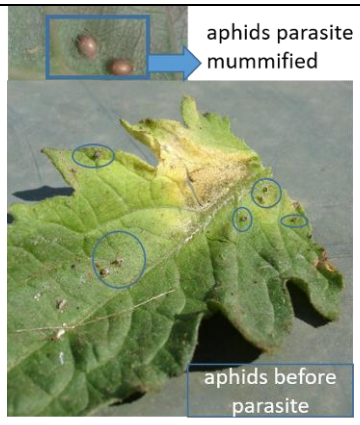

Figure 2. Aphid before parasite by braconid wasps and characteristic mummies (mummified aphids) after parasite; the beneficial effect of biological control

As can be seen from Table 1, the efficacy results of biological control of aphids consisted of a different release time depending on the three perspectives, namely: 1: 5 - 89.3%, at 1:10 - 87.2% and the 1:20 ratio - 49.2%. These show that the highest efficacy was achieved at the release time of 1: 5 and the highest and most useful for biological control was the parasite release rate at a ratio of 1: 10.

The studies and results obtained at a 1:20 ratio proved to be inappropriate for the release of the wasps because biological feasibility at a 1:20 ratio is not sufficient to reduce the population of aphids, requiring extra time and additional parasite specimens.

At the beginning of the experiment, there were 695 individuals of aphids, 10 days later their number increased to 1205.

Table 1

The efficacy of parasitic wasps in the biological control of aphids

Trials number	The initial ratio of the numbers of the parasite: host (aphid)	Number of aphids on 10 plants of tomatoes		The biological efficacy of the parasite in the %
		Before parasite infestation	10 days after the release of the parasite	
1	Control	695	1205	-
2	1:5	720	134	89.3
3	1:10	815	180	87.2
4	1:20	750	530	49.2
$HCP_{0.5}$				2.64
				0.82

It should be pointed out that in the growth and development of aphids in laboratory experiments should not exceed the limits so that they restore themselves to plants, it is only necessary to maintain them at the optimum level.

Studies on parasite reproduction have shown the possibility of growing in the laboratory. Its testing on tomato plants confirmed the effectiveness of their use by seasonal colonization against aphids on greenhouse vegetables. More exactly:

1. By developing laboratory breeding techniques aphids such as *Aphis craccivora, Myzodes persicae, Acyrtosiphon pisum* and *Aphis gossypii*. In the laboratory, it is easy to breed especially *Aphis craccivora* compared to other types of aphids.

2. In experiments to study the efficacy of parasite against tomato aphids it is shown that the different relationships between the parasite and host 1:5, 1:10, 1:20 can regulate the number of aphids but in varying degrees.

By details, the best results were obtained at a ratio of 1: 5 where after 10 days after infection there remained 134 aphids out of 720, with a parasite biological efficacy of 89.3%. In the 1:10 experiments, the efficiency is high because after 10 days of the release of the parasites, there were 180 aphids out of 815 before the alleged parasite, here the biological efficiency was 87.2%. In tests with a parasite / aphid ratio of 1:20, the effectiveness was less than 50%.

Studies on the efficacy of *Lysiphlebus fabarum* against the pests on the tomato plants have shown that they can reduce their population level to all the different variables (1: 5 and 1:10) the number of aphids in tomatoes, even in the 1:20 ratio. Their biological efficiency is 50% and in ratios of 1: 5 and 1:10 is 90%.

CONCLUSIONS

In non-polluting combat, we can successfully integrate the use of braconid wasps. By what has been achieved through laboratory experiments it can be concluded that they can greatly reduce aphids' populations, perhaps not in the same 90% in open field conditions, but something close. Importantly, it is possible to replace partially used insecticides on a large scale, which have disastrous effects on the environment and human health.

BIBLIOGRAPHY

ABBOTS W.S.A, 1925. Method of computing the effectiveness of insecticide 156 (USA).

GRENIER S., LIU W. H., 1990. Antifungals: mold control and safe levels in artificial media for Trichogramma (Hymenoptera, Trichogrammatidae). Entomophaga, 35: 285 290 (USA).

LI LI-YING, LIU WEN-HUI, 1997. Rearing Trichogramma spp, with artificial diets, containing hemolymph of different insects. Parasitoids and predators (insecta) of agricultural and forestry arthropod pests 335-337(CHN).

LI LI-YING, LIU WENHUI, CHEN CHAOSHIAN, HAN SHITYOU, SHIN JIACHI, DU HANSUN, FENG SHUYI, 1997. In vitro rearing of Trichogramma spp and anastatus sp in artificial "eggs" and the methods of mass production. Parasitoids and predators (insecta) of agricultural and forestry arthropod pests 344-357 (CHN).

АДАШКЕВИЧ Б.П., ШИЙКО Е.С, 1983. Разведение и хранение энтомофагов. Ташкент: Узбекистан, –С. 47-65 (UZ).

ДАВЛЕТШИНА А.Г., ГОМОЛИЦКАЯ Т.П., 1980. Экология и поведение наиболее эффективных паразитов и хищников//Энтомофаги вредителей сельскохозяйственных культур Узбекистана. Ташкент: Фан, С. 30-31 (UZ).

ДОСПЕХОВ Б.А, 1985. методика плевого опыта: Москва: колос,145с (UZ).

ЖУМАЕВ Р. А, 2016. In vitro rearing of trichogramma (Hymenoptera: Trichogrammatidae) // European Science Review № 9-10. Б 11-13 (AU).

ЖУМАЕВ Р. А, 2017. The technology of rearing Braconidae in Vitro in biolaboratory // European Science Review № 10. (DOI: htp://dx.doi.org/10.20534/ESR-17-3.4-3-5). Austria, Vienna. Б 3-5 (AU).