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Using Parasitic Entomophages In Controlling The Number Of Pests In Vegetable Agrobiocenoses

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Abstract

During the research, the species composition of Aphidiidae family representatives, particularly Lysiphlebus fabarum Marsch, and their biological effectiveness against plant aphids were widely studied and scientifically substantiated in managing the number of sucking pests of vegetable crops. The studies were mainly carried out in vegetable-growing fields infested with aphids in the districts of Tashkent and Syrdarya regions, as well as in scientific research laboratories specializing in biological plant protection. The most widespread plant aphids Aphis craccivora Koch, Aphis gossypii Glow, Rhopalosiphum nymphaeae, Brevicoryne brassicae and the infestation rates of their effective parasitic entomophage Lysiphlebus fabarum Marsch were examined.

Keywords: Vegetables, biocenosis, sucking pest, agrobiocenosis, parasitic entomophage, plant aphids, feeding, species composition, phytophagous, biological method, bioecology, plant phenology, biological efficiency.

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1. Introduction

Global climate change is increasingly influencing the prevalence and damaging capacity of pests and diseases in agricultural crops. “The negative impact of pests on global agriculture is estimated at 1.4 trillion US dollars, which accounts for 5% of the global GDP.” Therefore, ensuring food security and improving pest control systems in agriculture remains an urgent issue.

In recent years, the use of biological methods to control pests in vegetable crops has expanded, which requires improving available technologies, identifying efficient entomophage species, and implementing intensive biological protection methods in practice.

Large-scale reforms are being carried out in agriculture in our republic, and special attention is given to protecting crops from pests. The rapid increase in population and active export processes necessitate the development of new technologies. Environmentally friendly and effective methods of protecting vegetable crops from pests and diseases are now of great importance. One of the primary tasks is improving the breeding and application of beneficial insects against harmful pests. [1,2,5]

Research Objective. Chemical methods alone are not

sufficient to control sucking pests of vegetable crops, as they do not always provide the expected results due to resistance development and pesticide residue accumulation. Therefore, developing environmentally safe biological methods against sucking pests of cultivated plants is highly relevant today.

Based on this, our main objective was to study the species composition and harmfulness of sucking pests in widely cultivated vegetable crops and develop scientifically grounded biological control measures that are harmless to the environment. [3,5,7,9]

Research Tasks. The scientific research is aimed at solving the following tasks: to identify the species composition of sucking pests in vegetable crops; to study the bioecology of the main sucking pests; to investigate the economic threshold levels of sucking pests; to develop the parasitic entomophages of sucking pests and determine their scientifically based application rates; and to apply biological control agents against sucking pests and study their economic effectiveness.

2. Method

The research materials included sucking pests: Aphis craccivora Koch, Aphis gossypii Glover, Brevicoryne brassicae, Rhopalosiphum nymphaeae, their parasitic entomophages: Lysiphlebus fabarum Marsch, and biological control measures against these pests.To determine the species composition of sucking pests and conduct field experiments, studies were carried out in crop fields, as well as in specialized containers, trays, and entomological cages, using the methods of I.V. Kozhanchikov (1965), K.K. Fasulati (1966), and S.M. Pospelov (1969).Agrotechnical measures were implemented according to the standard procedures considered optimal for the region, and B.D. Azimov's methods (1990; 1995) were employed to study plant phenology and crop yields. Pest Infestation Level and Economic Threshold

The level of pest infestation and the economic threshold were determined using the method of V.I. Tansky (1975, 1979, 1985). All numerical data obtained from the experiments were statistically analyzed following the methodological guidelines of B.A. Dospehov and A.K. Gar.

3. Results And Discussion

Studies on sucking pests of vegetable crops were conducted in the vegetable fields of Tashkent region, focusing on different types of plant sap feeders. Among the parasitic entomophages, the species Lysiphlebus fabarum was observed on several types of plant sap feeders. Based on separate studies (Qibray District, "Salar Agro Faiz" farm), its seasonal formation, development, and population density in agro-biocenoses were determined.Observations indicate that, in the agro-biocenoses of Tashkent region, colonies of several types of plant sap feeders predominantly occur. The study specifically investigated the occurrence levels of the parasitic entomophage Lysiphlebus fabarum on Aphis craccivora Koch, Aphis gossypii Glover, and Rhopalosiphum nymphaeae.

Preliminary Research. Preliminary studies were conducted in 1-hectare tomato fields planted under a fruit orchard at the "Salar Agro Faiz" farm in Qibray District, Tashkent region. According to these studies, the development of plant sap feeders (Aphis craccivora Koch) on tomato crops began in the second decade of April. During this period, the emergence of the first generation of the parasitic wasp Lysiphlebus was observed. The ratio of the first-generation parasitoids to their hosts was studied, and the initial parasitoid-to-host ratio was found to be 1:50 (Figure 1).

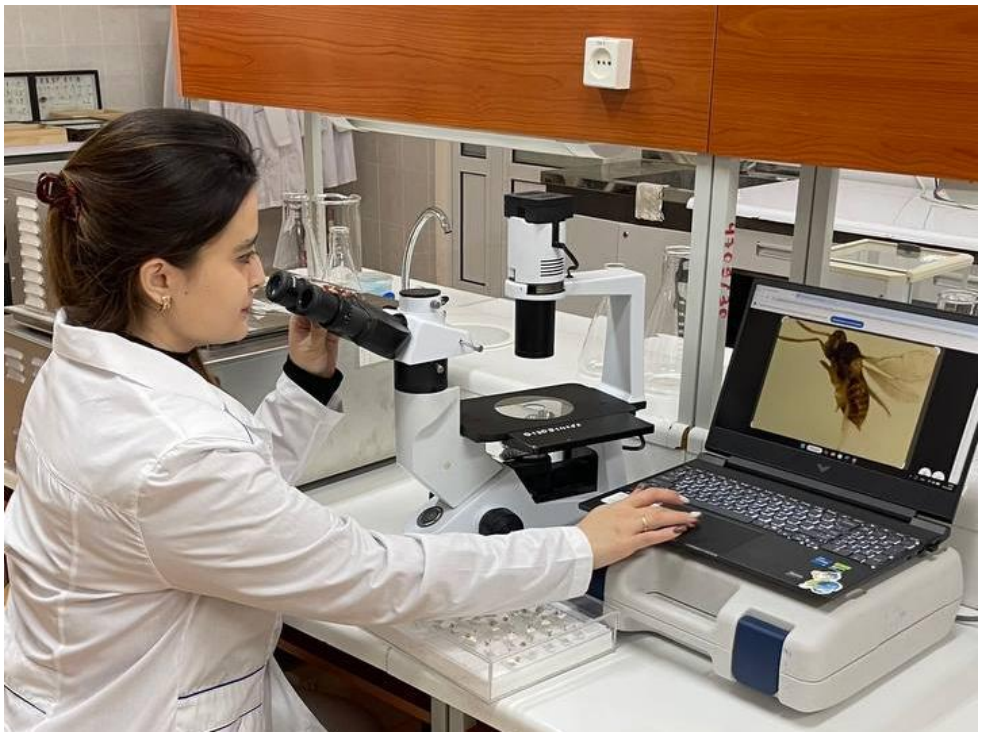

Figure 1. Morphological systematics of parasitic entomophages distributed in the vegetable agro-biocenosis (TDAU, 10.12.2025).

By the third decade of April, the parasitoid-to-host ratio was observed to have decreased to 1:30. To determine the parasitism rate of Lysiphlebus fabarum on different types of plant sap feeders, tomato seedlings were transplanted into 50 trays in the biological laboratory (Tashkent State Agrarian University, Bio-laboratory, 2017–2019). Aphis craccivora Koch individuals were collected from seedlings in the "Salar Agro Faiz" farm fields and introduced into the trays for the study.

The trays were isolated using special entomological nets, and Lysiphlebus parasitoids were introduced at a 1:1 male-to-female ratio. The results of the study showed that the female parasitoid laid an average of 82.3 ± 0.02 eggs on Aphis craccivora Koch individuals. The parasitoids that developed and emerged from these sap feeders lived for 7.4 ± 0.02 days, with a sex ratio of 1:4 (♂:♀), and the infestation rate of the host generation reached 87.9%.

The next stage of the research focused on studying the development of the parasitoid Lysiphlebus fabarum on Rhopalosiphum nymphaeae (nymph aphids). Wild nymph aphids growing on plants in the Botanical Garden of Tashkent city and infested with these sap feeders were observed. The nymph aphids collected from these plants were transferred to laboratory-reared nymph plants in trays, which were isolated with special entomological nets. Previously prepared and fed Lysiphlebus parasitoids were introduced at a 1:1 male-to-female ratio.

Observations began on the fifth day and were conducted daily thereafter. The female parasitoid attacked an average of 74.2 ± 0.05 nymph aphids (Figure 2). Parasitoids that developed from these sap feeders lived for 6.8 ± 0.04 days, with a sex ratio of 1:5 (♂:♀), and the infestation rate of the host generation was 62.6%.

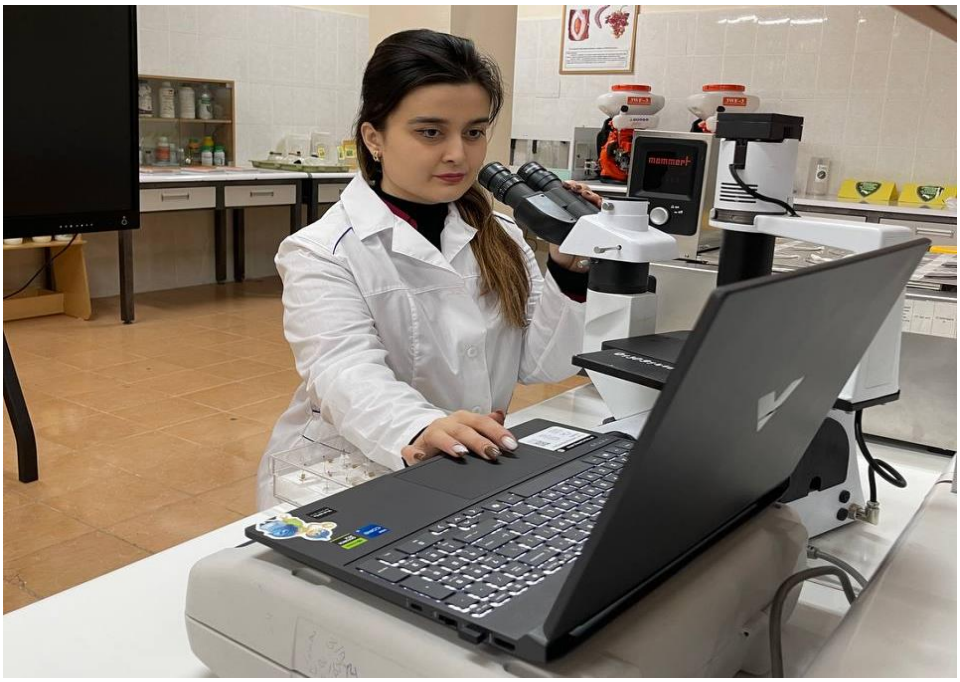

Figure 2. The process of morphological systematics of parasitic entomophages distributed in the vegetable agro-biocenosis (TDAU, 10.12.2025).

The next stage of the research was conducted on cotton aphids. This pest is widespread in our country and causes significant economic damage to cotton crops. In recent years, due to the irregular application of chemical agents on these aphids, an increase in resistance to chemical treatments has been observed. This results in severe damage in cotton fields, reducing the growth and development of the cotton plants. Consequently, cotton yield decreases, and fiber quality deteriorates.

For this reason, in our research, we conducted extensive studies on the bioecology of this aphid species and the application of the parasitoid Lysiphlebus fabarum. Cotton aphids were also collected and brought to the laboratory using the methods described above. This period corresponded to June 10–20, during which the average air temperature was +35 °C and the relative humidity was 49%.

Determination of biological efficacy

No.	Aphid Species	Fecundity of Female (eggs)	Longevity (days)	Sex Ratio (♂:♀)	Infestation Rate of Hosts (%)
1	Legume crops and cowpea aphid (*Aphis craccivora* Koch)	82.3 ± 0.02	7.4 ± 0.02	1:4	87.9
2	Nymph aphid (*Rhopalosiphum nymphaeae*)	74.2 ± 0.05	6.8 ± 0.04	1:5	62.6

No.	Aphid Species	Fecundity of Female (eggs)	Longevity (days)	Sex Ratio (♂:♀)	Infestation Rate of Hosts (%)
3	Cotton aphid (*Aphis gossypii*)	79.6 ± 0.03	7.1 ± 0.02	1:5	67.2
4	Cabbage aphid (*Brevicoryne brassicae*)	62.3 ± 0.04	5.4 ± 0.02	1:4	57.9

In laboratory conditions, Aphis gossypii aphids were introduced onto 100 specially prepared trays containing tobacco seedlings, and the trays were isolated using special entomological nets. Within 2–3 days, the aphids had well established themselves on the newly growing shoots of the tobacco plants. Subsequently, pre-fed Lysiphlebus fabarum parasitoids were introduced at a 1:1 (♂:♀) male-to-female ratio.

Observations began on the fifth day. It was found that the female parasitoid attacked an average of 79.6 ± 0.03 Aphis gossypii individuals. Parasitoids that developed from these sap feeders lived for 7.1 ± 0.02 days, with a sex ratio of 1:5 (♂:♀). Examination of the aphids that had become mummified and swollen as a result of parasitism showed that the infestation rate of the host generation reached 67.2% (Table 1).

According to the research results, the parasitoid Lysiphlebus fabarum showed very good development on Aphis craccovora Koch, with a high longevity of 7.4 ± 0.02 days and a biological efficiency of 87.9%. Compared to other species, its development and fecundity were slightly lower on cabbage aphids.The next stage of the research focused on studying the biological indicators of Lysiphlebus fabarum development on aphid species in the populations of Syrdarya region. Accordingly, studies were conducted in cotton and vegetable fields at the “Biloliddin Faiz” farm in Saykhonobod District, Syrdarya region. The research was carried out from June 15 to 20, during which the average air temperature was +38 °C and the relative humidity was 46%.

4. Conclusion

The parasitoids that developed on this aphid species lived for 5.1 ± 0.05 days, with a sex ratio of 1:4 (♂:♀). Examination of aphids that had become mummified and swollen due to parasitism showed that the infestation rate of the host generation reached 72.6%.In studies conducted to determine the biological indicators of Lysiphlebus fabarum on cabbage aphids (Brevicoryne brassicae) in the Syrdarya region population, cabbage seedlings heavily infested with aphids were isolated using special entomological nets, and Lysiphlebus fabarum parasitoids were introduced at a 1:1 male-to-female ratio.

The study of parasitoid development began on the fifth day. The female parasitoid laid an average of 68.1 ± 0.05 eggs on cabbage aphids (Brevicoryne brassicae). Parasitoids that developed from these aphids lived for 5.1 ± 0.05 days, with a sex ratio of 1:5 (♂:♀), and the infestation rate of the host generation was observed to be 60.0%.

Studies on the development of Lysiphlebus fabarum on different aphid species showed that the biological indicators of this parasitoid were higher in Tashkent region. In contrast, they were observed to be somewhat lower in Syrdarya region. The main reason for this difference was that the lower relative humidity and higher air temperature in Syrdarya region negatively affected the development, fecundity, longevity, and biological efficiency of the parasitoid.

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