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BIOLOGICAL CONTROL AGAINST HARMFUL INSECTS IN CEREAL CROPS**Bekchanov Zokirjon Botirovich**

Independent Researcher, Institute of Plant Quarantine and Protection

Abstract:

In the climatic conditions of Uzbekistan, the active natural enemies of harmful insects are: Telenomus species – *Telenomus chloropus* Thoms., *Telenomus sokolovi* Mayr., *Trissolcus grandis* Thoms., *Trissolcus simony* Mayr., *Trissolcus viktorovi* Kozl., and parasitic flies: *Alophora (Phasia) subcoleoptrata* L., *Helomyia lateralis* Meig., *Phasia crassipennis* F., *Clytiomyia hulluo* F.. Egg-parasitizing Telenomus species multiply during the egg-laying period of harmful insects, naturally affecting 20-23% of the insect eggs.

Keywords: Cereal crops, harmful insects, natural enemies, Telenomus species, pest insects, wheat thrips, wireworms, cereal aphids.

Introduction:

According to FAO data, globally, wheat ranks first in terms of cultivation area in agricultural crops, and wheat products also occupy a major position in terms of food consumption. Therefore, expanding cereal crop areas, increasing yields, creating new promising varieties, developing resource-efficient technologies based on innovative approaches, and preventing crop damage from harmful organisms and pests are among the urgent issues today.

In the climatic conditions of Uzbekistan, the main pests of cereal crops include harmful insects, wheat thrips, wireworms, and cereal aphids, which cause significant damage [3, 4].

Among the pests of the Hemiptera order, cereal pests are the most widespread and harmful species in the world fauna. This group has been identified with 40,000 species belonging to 58 families. According to paleontologists, the emergence of Hemiptera dates back to the Mesozoic era. In the Palaearctic region, nearly 4,000

species of Hemiptera are known, belonging to 800 genera. In the countries of the CIS, about 2,000 species of Hemiptera are identified, many of which inhabit the southern and southeastern regions, including deserts, semi-deserts, and foothill areas [5, 6].

When the average daily temperature is 20°C, the developmental period of pests from egg to mature form lasts approximately 50 days. If the temperature is higher than this, the development period may be shorter. The grain bug, Austrian bug, broad-shouldered bugs, and other widespread pests belong to the order Hemiptera, which are incomplete metamorphosis insects, meaning they do not undergo a pupal stage. Their larvae molt five times before becoming mature insects [1].

In the mature forms of these pests, parasitic flies of the genus *Phasia* parasitize them. The larvae of *Phasia* emerge from eggs deposited on the pest's body, burrow into the internal parts of the pest's body, and develop there. In reducing the damage and numbers of harmful pests, the significance of *Phasia* flies ranks second after *Telenomus* species. This is because, after causing damage to crops, *Phasia* parasitizes the larvae and young pests [5, 6].

The destruction of harmful pests by diseases is mainly observed in their overwintering sites. The pathogens responsible for these diseases include various fungi, bacteria, and viruses. Among all the diseases, the importance of the white muscardine fungus (*Beauveria bassiana*) is particularly high [7, 8].

Harmful insects begin to damage cereal crops from the first days after emerging from hibernation. Their greatest damage is due to the fact that the digestive system of the pest larvae is outside the body, and they release saliva containing proteolytic enzymes to digest protein substances from plants, making the plants more susceptible to damage. This saliva is toxic to the plants. During the heading period of wheat, plants affected by this toxin show yellowing, curling, and drying of leaves, and the plants fall behind in growth and often fail to yield any grain [7].

According to V.I. Rumyantseva's [10] research in Russia, it was found that with an average of 1-3 pests and their offspring (larvae) per square meter, the wheat yield decreases by 6-7 quintals per hectare. When the number of pests exceeds 3 per square meter, sparse growth and complete crop failure are often observed in autumn wheat.

Many researchers have paid great attention to studying the entomophages of harmful pests. Various predatory beetles, spiders, ants, staphylinids, and other predators have been identified at different developmental stages of these pests. Several species of spiders, ants, desert locusts, beetles from the *Antesidae* family, and both large and small types of beetles feed on the eggs of pests [3, 4]. Many predatory beetles, spiders, and members of the Staphylinidae family feed on the larvae and adult forms of harmful pests, while parasitic species include *Syrphidae* flies and *Phasia* parasitic flies [3, 4]. The significant role of egg parasitoids from the *Telenomus* and *Trissolcus* genera is recognized in reducing the numbers of harmful pests. To increase the effectiveness of egg parasitoids in managing pest populations, attempts were made in the Krasnodar region, Voronezh, and Kharkiv provinces to apply them using seasonal colonization methods. However, this method showed limited success, with the damage to pest eggs increasing by only 10-20% compared to the control. The main reasons for this low efficacy include mismatched emergence times of the parasite and host in nature, poor searching abilities, low migration activity over long distances, and insufficient quality of the laboratory-reared populations [3, 4].

The widespread use of pyrethroid pesticides such as Decis, Cymbush, Sumicidin, Fury, and others in wheat fields during the years 1996-2000 has led to the formation of resistant pest populations in the entire North Caucasus region [2]. This has caused another serious problem, disrupting the biocenotic balance in agroecosystems.

In protecting wheat fields from harmful pests, it is crucial to explore and apply natural predators, such as entomophages, to control pest populations and limit their

excessive reproduction. Natural entomophages, such as *Phasia* parasitic flies developing inside the pest's body, egg parasitoids like *Telenomus*, and various bird species, play a significant role [3, 4].

According to research by A.F. Yildirim, E. Kinaci, and M. Uysal [9], one of the factors limiting the excessive multiplication of pests is the role of disease-causing microorganisms. In developing microbiological methods to combat harmful pests, searching for entomopathogenic microorganisms from nature, isolating them, studying their efficacy, and developing microbiological products based on these microorganisms are of great importance.

Currently, researchers focus on finding and applying various species of local entomopathogenic microorganisms in natural conditions to develop biological control methods for harmful pests, which remain a significant challenge.

Research Methods: The studies were conducted using general entomological methods developed by V.B. Golub et al., V.I. Tanskiy, S.P. Starostin, V.T. Alekhin, and others, and economic efficiency methods developed by V.I. Tanskiy and A.K. Tuleeva. The species of harmful pests were identified using entomological identification guides developed by I.Ya. Polyakov, D.M. Poloskina, and the species of natural entomophages were identified using the references of K.E. Voronin and others.

Research Results: Natural entomophages and beneficial microorganisms in all agricultural ecosystems play a key role in reducing pest populations. These natural enemies eliminate pests through predation, parasitism, or sometimes through the effects of pathogenic microorganisms.

In Uzbekistan, the natural enemies of pests in cereal fields have not been sufficiently studied. Therefore, in 2020-2022, research was conducted to study the natural enemies of harmful pests in wheat, their species composition, and their role in reducing pest numbers.

Through targeted observations, the species composition and significance of entomophages of pests in wheat fields were determined. During the study, the

following active natural enemies of harmful pests were identified: *Telenomus chloropus* Thoms., *Telenomus sokolovi* Mayr., *Trissolcus grandis* Thoms., *Trissolcus simony* Mayr., *Trissolcus viktorovi* Kozl.; *Phasia* parasitic flies: *Alophora* (*Phasia*) *subcoleoptrata* L., *Helomyia lateralis* Meig., *Phasia crassipennis* F., *Clytiomyia hulluo* F.

The research showed that during the egg-laying period of harmful pests in wheat fields, pest eggs were collected and analyzed for parasitism. The results revealed that natural entomophages of pests, particularly egg parasitoids *Telenomus* and *Phasia* parasitic flies, were present in wheat ecosystems (Table 1).

Table 1

Occurrence of Parasitic Entomophages in the Wheat Biocenosis
(Toshkent Region, 2020-2022)

No	Latin names	Uzbek names	Occurrence in wheat agrobiocenosis
1.	<i>Telenomus chloropus</i> Thoms.	☐ Telenomus	+++
2.	<i>Telenomus sokolovi</i> Mayr.	☐ Telenomus	++
3.	<i>Trissolcus grandis</i> Thoms.	☐ Telenomus	+
4.	<i>Trissolcus simony</i> Mayr.	☐ Telenomus	+
5.	<i>Trissolcus viktorovi</i> Kozl.	☐ Telenomus	+
6.	<i>Alophora</i> (<i>Phasia</i>) <i>subcoleoptrata</i> L.	☐ Phasia wasp	+++
7.	<i>Helomyia lateralis</i> Meig.	☐ Phasia wasp	+
8.	<i>Phasia crassipennis</i> F.	☐ Telenomus	+
9.	<i>Clytiomyia hulluo</i> F.	☐ Telenomus	+

Conventional signs:

- +++ frequent
- ++ moderate
- rare

In wheat fields, when harmful pests begin laying eggs, egg parasitoids such as *Telenomus* appear and parasitize the pest eggs, playing a significant role in reducing the pest population.

During the research, we conducted observations to study the development of egg parasitoids *Telenomus* under field conditions. The emergence of parasitoids in these fields was first observed when the average daily air temperature exceeded 18-20°C.

By the end of the first decade of April 2020, harmful pest eggs in wheat fields began to be parasitized by *Telenomus* parasitoids. During the second decade of April, an increase in parasitism was observed, and by the end of the month, the highest rate was recorded, with an average of 15% of the harmful pest eggs being parasitized (Table 2).

In 2021, the active increase in the number of harmful pest eggs parasitized by *Telenomus* was observed starting from the first ten days of April. At the beginning of the second ten-day period, about 5% of the eggs were parasitized, and by the end of April, this figure reached 23%. At the beginning of May, 20% of the eggs were parasitized, but by the end of the first ten-day period, the rate dropped to 5%. This drop was explained by the heavy rainfall at the beginning of May.

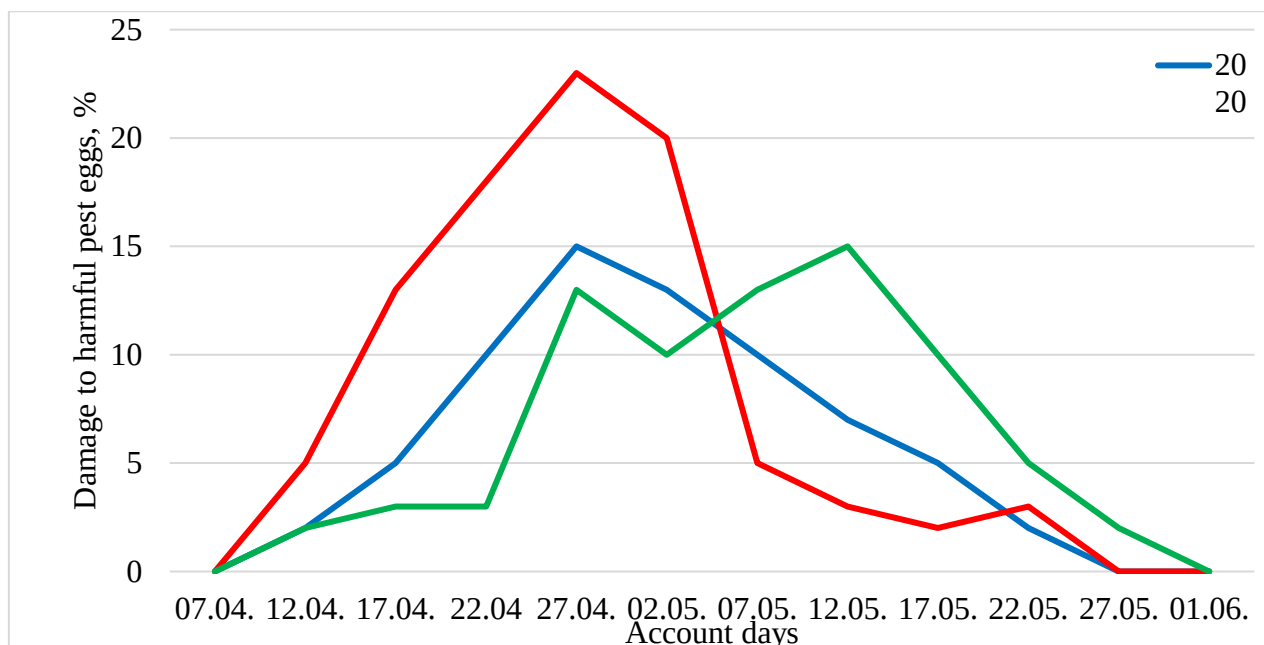
In 2022, parasitism of harmful pest eggs by *Telenomus* started in the first ten days of April, but it developed slowly until the beginning of the third ten-day period, reaching an average of 3%. By the end of April, parasitism increased to 13%, and by the fourth decade of May, the harmful pest eggs were parasitized at an average rate of 15%.

Table 2:

(Note: This section references a table that is not provided in the text. It would need to include the relevant data in Table 2.)

Infection of Harmful Pest Eggs with Egg Parasitoids *Telenomus* in Wheat Fields

(Toshkent Region, Kuyi Chirchiq District, "TCT Agro Cluster" LLC, 2020-2022)



In the years when the research was conducted, a decrease in the number of harmful pest eggs in wheat fields was observed alongside a reduction in the number of egg parasitoids *Telenomus*. However, even in small numbers, parasitism of late-laid eggs continued until the end of May.

From the obtained results, it can be concluded that the egg parasitoids *Telenomus* that parasitize harmful pest eggs increase during the active egg-laying period of the pest, naturally parasitizing 20-23% of the pest eggs.

Although the appearance of natural enemies in wheat fields is observed later than the emergence of harmful pests, they remain in the bio-community until the ripening of cereal crops. This is because, in addition to the harmful pest, other types of beetles are also present in wheat fields.

Based on the experimental research, the following conclusions can be made: the active natural enemies of the harmful pest include egg parasitoids *Telenomus* species such as *Telenomus chloropus* Thoms., *Telenomus sokolovi* Mayr., *Trissolcus grandis* Thoms., *Trissolcus simony* Mayr., *Trissolcus viktorovi* Kozl., and *Phasia* species, including *Alophora (Phasia) subcoleoptrata* L., *Helomyia lateralis* Meig., *Phasia crassipennis* F., and *Clytiomyia hulluo* F.

Egg parasitoids Telenomus, which parasitize harmful pest eggs, increase during the active egg-laying period and naturally parasitize up to 20-23% of the pest eggs.

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