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DISTRIBUTION, DAMAGE ASSESSMENT, AND BIOLOGICAL CONTROL OF MAJOR PESTS OF WINTER WHEAT

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Abstract
This article presents the findings of scientific research conducted on the distribution and damage levels of the most harmful pests affecting winter wheat crops in the Syrdarya region of Uzbekistan. The study focuses on the pests Eurygaster integriceps, Oulema melanopus, Haplothrips tritici, and Schizaphis graminum, assessing their infestation rates and economic impact. Furthermore, the research explores the biological control measures aimed at mitigating their harmful effects and enhancing crop protection strategies.

Keywords: Wheat, leaf, biopreparation, pest, infestation level, larva, imago, Eurygaster integriceps, Oulema melanopus, biological efficacy.

Introduction

Wheat is considered one of the primary staple crops essential for ensuring global food security, including that of the population of Uzbekistan [4]. Due to its adaptability to a wide range of climatic conditions, wheat is extensively cultivated in many countries and serves as the main food source for more than half of the world's population. Globally, wheat production amounts to approximately 770 million tons. China, India, the United States, and Russia are the leading wheat-producing countries [5;10]. Wheat productivity is negatively affected by various biotic and abiotic stress factors, which in some cases may result in complete crop loss [7]. Abiotic stresses, emerging as a consequence of global warming and climate change, pose serious threats

to wheat cultivation. Additionally, during certain periods, the population density of pests and diseases exceeds economic threshold levels, further exacerbating yield losses [20].

In the Republic of Uzbekistan, winter wheat is cultivated on more than 1 million hectares of irrigated land and approximately 200,000 hectares of rainfed (non-irrigated) areas. In recent ears, domestically produced wheat has fully met the population's demand for this essential crop. However, during the cultivation and maintenance phases, wheat is exposed to a range of pests and diseases that negatively impact yield and grain quality.

In particular, the Sunn pest (*Eurygaster integriceps*) and the cereal leaf beetle (*Oulema melanopus*) are among the most damaging insect pests, causing significant yield losses and reducing the quality of wheat production. If appropriate control measures are not implemented, these pests can lead to the loss of up to 30–40% of the total harvest [3;30]. The Sunn pest (*Eurygaster integriceps*) and the cereal leaf beetle (*Oulema melanopus*) are specialized phytophagous pests of wheat and are regarded as major threats to wheat production in many grain-growing countries [9;24]. According to various researchers, nearly 100 species of these pests have been identified globally. They are predominantly found in temperate and tropical regions, where they infest host plants belonging to the families *Amaranthaceae*, *Commelinaceae*, *Compositae*, *Cyperaceae*, *Gramineae*, and *Leguminosae* [28].

In spring, when temperatures exceed 10–12°C, adult insects emerge from overwintering sites and migrate to cereal crop fields, initiating damage. The adults then lay eggs, and the emerging larvae of *Oulema melanopus* feed by chewing on wheat leaves, causing substantial foliar damage. Meanwhile, the larvae of *Eurygaster integriceps* typically settle within wheat ears and feed by sucking the sap from developing grains during the milk and dough stages, resulting in significant yield and quality losses. As a result, grains with reduced gluten quality are produced, and overall yield declines [29]. Without effective control measures, a significant portion of the harvest can be lost [2;17]. For instance, damage caused by the cereal leaf beetle has been reported in Syria, India, Pakistan, Iran, the United States, and Canada, resulting in yield losses of up to 55% in spring wheat and 23% in winter wheat [9;23]. Larvae cause more damage than adults because they consume 1 to 10 times more plant biomass relative to their body weight [6;22]. Furthermore, during feeding, larvae contaminate wheat leaves with sticky substances and excrement. In Russia, the cereal leaf beetle is also a major pest of wheat, and control measures are typically implemented when the size of larvae hatched from the first laid eggs reaches approximately 4 mm and when there is a large number of larvae present [29;31].

Materials and Methods

Between 2023 and 2025, field experiments were conducted in winter wheat fields of the Syrdarya region to study the distribution and damage caused by the main pests. To assess the presence of the Sunn pest (*Eurygaster integriceps*) in wheat fields, 20 samples were taken from each field, with each sample covering an area of 0.25 m² (50×50 cm). The number of insects present in all samples was counted, and the average number per 0.25 m² was calculated. For the assessment of the density of the cereal leaf beetle (*Oulema melanopus*) adults and larvae per 1 m², plants were sampled along the diagonal of the field at 10 equidistant points. At each point, 25 moderately developed plants were examined. From each plant, 50 leaves (flag leaf and the

second and third leaves from the top) were randomly collected, carefully inspected, and the number of pests recorded.

The timing of pest emergence and population assessment were carried out following established methods by Polyakov et al. (1984), Osmolovsky G.E. and N.V.Bondarenko (1980), V.B.Golub et al. (1980), and G.I.Dorokhova (1995). The number and population density of pests in the wheat fields were determined using logarithmic scales. Damage assessment was conducted based on the 0–5 scale developed by S.Stamenkov and L.Pankov (1991), as well as methods proposed by Rouag H. et al. (2012). In field conditions, the insecticidal activity of the tested preparations was assessed using the methodological guidelines of Khojaev (2004), and biological efficacy was calculated using the formula developed by Püntener (1981). The experimental treatments included the biopreparation "Bioturin" at application rates of 2.0 and 3.0 l/ha, the reference insecticide Killer NEO 10% EC at 0.1 l/ha, and an untreated control.

Experiments were conducted under the agroecological conditions of the central region of the Republic (Syrdarya). To determine biological efficacy, insect counts were performed in all treatment variants before application and on days 3, 7, 14, and 21 after spraying. The study was conducted in a randomized design with three replications per treatment, including the untreated control. The working solution was applied at a rate of 300 liters per hectare.

Results

In April 2023–2025, monitoring was conducted in winter wheat fields across Syrdarya region to assess the occurrence and infestation levels of major pests: *Eurygaster integriceps*, *Oulema melanopus*, *Haplothrips tritici*, and *Schizaphis graminum*. To determine the distribution and damage intensity of these pests in wheat crops, field surveys were carried out in farms located in the districts of Khavast, Boyovut, Okoltin, and Sardoba. In the 11.0-hectare field of the "Abdullabekov Abbos" farm in Khavast district, 20 randomly selected samples (each 0.25 m² in size, i.e., 50 × 50 cm) were collected to detect the presence of the Sunn pest (*E. integriceps*). Based on the insect counts, the average pest density was found to be 1.2 individuals per m². The damage level was assessed using a 5-point scale, where 1 point indicated approximately 20% of plants being affected.

For *Oulema melanopus*, adult beetles and larvae were sampled from 10 evenly spaced locations along the diagonal of a 1 m² plot. From these locations, 25 moderately developed plants were examined, and 50 leaves (including the flag leaf and the second and third leaves from the top) were randomly collected and inspected for pest infestation. The summarized data are presented in Table 1. According to the table, an average of 21.2 adult and larval individuals of *O. melanopus* were recorded per 50 leaves, with leaf damage rated at 1–2 points (15–20%). Wheat thrips (*H.tritici*) and aphids (*S.graminum*) were found in densities ranging from 36.2 to 49.3 individuals per 10 stems, with grain damage levels estimated at 1–2 points (10–15%). In the 39.0-hectare wheat field of the "Elyor O'gli Asilbek" farm, the density of *E. integriceps* reached 1.3 individuals per m², with grain damage rated at 1 point. The number of *O. melanopus* adults and larvae was recorded at 21.6 individuals per 50 leaves, with corresponding damage rated at 1–2 points (15–20%). Wheat thrips and aphids were observed at 33.4–53.4 individuals per 10 stems, with grain damage levels ranging from 1–2 points (10–15%).

In the wheat field of the "Alp-Jamol" farm located in Boyovut district, the density of *Eurygaster integriceps* was found to be 2.0 individuals per m², with grain damage assessed at 2 points on the 5-point scale. The number of *Oulema melanopus* adults and larvae averaged 22.3 individuals per 50 leaves, with leaf damage levels recorded at 1–2 points (15–20%). Wheat thrips (*Haplothrips tritici*) and aphids (*Schizaphis graminum*) were found in densities ranging from 34.3 to 61.6 individuals per 10 stems, with grain damage levels estimated at 1–2 points (10–20%). In the field of the "Zo‘r Ziyokor" farm, *E. integriceps* was recorded at a density of 1.1 individuals per m², with grain damage assessed at 1 point. The number of *O. melanopus* adults and larvae reached 32.1 individuals per 50 flag leaves, with damage rated at 2–3 points (15–25%). Wheat thrips and aphids were found at densities of 27.6–45.3 individuals per 10 stems, and grain damage was rated at 1–2 points (10–15%).

In the 5.1-hectare wheat field of the "Agro Okoltin Ko‘rki" farm in Okoltin district, the density of *Eurygaster integriceps* reached 2.7 individuals per m², with a damage level of 2 points. The number of *Oulema melanopus* adults and larvae was recorded at 22.0 individuals per 50 flag leaves, with leaf damage assessed at 1–2 points (10–15%). Wheat thrips (*Haplothrips tritici*) and aphids (*Schizaphis graminum*) ranged from 25.3 to 42.4 individuals per 10 stems, with grain damage levels of 1–2 points (10–15%). In the 16-hectare field of the "Ulug‘bek Shakin Sharof" farm, the density of *E. integriceps* was 0.9 individuals per m², and the grain damage was rated at 1 point. The number of *O. melanopus* beetles and larvae was 22.8 per 50 flag leaves, with a damage level of 1–2 points (10–15%). Wheat thrips and aphid densities ranged from 23.2 to 65.3 per 10 stems, with grain damage varying from 1 to 2 points (10–25%).

In the 9.1-hectare wheat field of the "Oqqayin" farm in Sardoba district, *E. integriceps* was found at a density of 1.5 individuals per m², with damage assessed at 1 point. The number of *O. melanopus* adults and larvae reached 35.1 per 50 flag leaves, with a damage level of 2–3 points (15–25%). Wheat thrips and aphids were recorded at 28.5–45.2 per 10 stems, with grain damage rated at 1–2 points (10–15%).

In the "Qo‘shchinor Do‘stlik Yeri" farm located in the Qo‘shchinor area, *E. integriceps* was observed at 1.7 individuals per m², with grain damage assessed at 1 point. The number of *O. melanopus* beetles and larvae was 24.8 per 50 flag leaves, with leaf damage levels of 2–3 points (15–20%). Thrips and aphids ranged from 31.6 to 47.3 per 10 stems, with grain damage levels estimated at 1–2 points (10–15%) (see Table 1).

Effectiveness of the Bioturin Biopreparation Against *Olema melanopus*

Field experiments were conducted under natural agro-ecological conditions in Syrdarya region to evaluate the insecticidal efficacy of the entomopathogenic bacterial preparation *Bioturin*, based on the strain *Bacillus thuringiensis* 26/1, isolated from local insect populations. The trials were aimed at assessing its effectiveness against the leaf beetle (*Olema melanopus*), a major pest of wheat. The experiments were carried out in the wheat fields of the "Elyor O‘gli Asilbek" farm located in Khavast district, Syrdarya region. The results of the study are presented in Figure 1.

Application of the microbiological agent *Bioturin* at rates of 2.0 and 3.0 L/ha showed high insecticidal activity against *O. melanopus* larvae, with the highest biological efficacy observed on the 14th day after application. At this time point, *Bioturin* demonstrated a biological

effectiveness of 72.2% to 79.5%. As a reference (standard) treatment, the chemical insecticide Killer NEO, 10% EC, applied at 0.1 l/ha, resulted in a mortality rate of 84.7% (Figure 1).

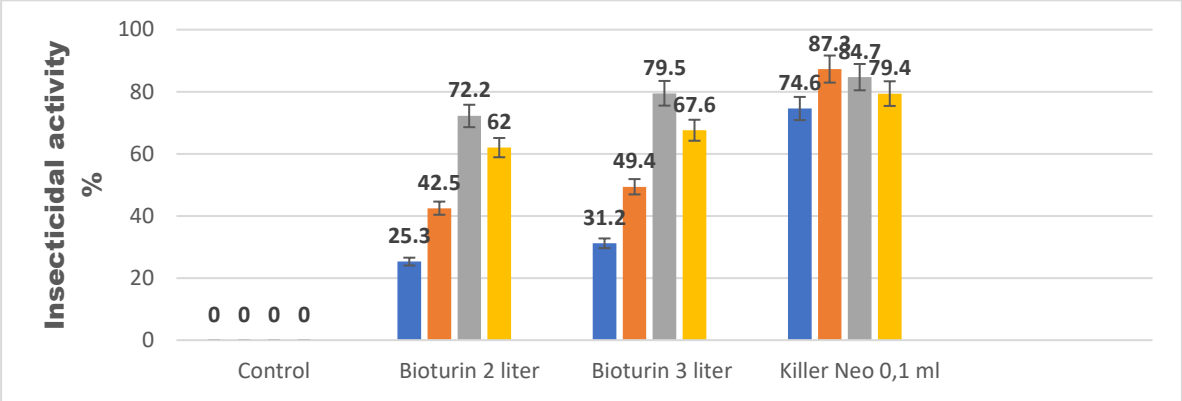

Figure 1. Biological Effectiveness of the *Bioturin* Biopreparation Against *Olema melanopus* in Wheat Fields of "Elyor O'gli Asilbek" Farm, Khavast District, Syrdarya Region

Conclusions

1. The agro-ecological conditions of the Syrdarya region are favorable for the development of major wheat pests such as the sunn pest (*Eurygaster integriceps*), the leaf beetle (*Olema melanopus*), wheat thrips (*Haplothrips tritici*), and aphids (*Schizaphis graminum*). These pests were found to be widespread across all surveyed wheat fields, with infestation severity ranging from 1–2 to 2–3 points on a standardized damage scale.
2. The microbial biopesticide "Bioturin", formulated based on *Bacillus thuringiensis* and applied at rates of 2.0–3.0 l/ha, demonstrated high biological efficacy against *Olema melanopus* larvae under field conditions. The product provided an effective biological control option for wheat protection, achieving 72.2–79.5% pest mortality.

3. 1-Table.
4. Distribution and Damage of Major Pests in Wheat Fields
5. (Syrdarya Region, 2023–2025)

№	District	Farmers Household	Wheat Area, ha	No. of *E. integriceps* per 1 m² and damage level		No. of *O. melanopus* per 50 leaves and damage level		No. of *H. tritici* per 10 stems and damage level		No. of *S. graminum* per 10 stems and damage level	
				piece	score	piece	score	piece	score	piece	score
1.	Xovos	Abdullabekov Abbos	11,0	1,2	1	21,2	1-2	36,2	1	49,3	2
2.		Elyor o'g'li Asilbek	13,4	1,3	1	21,6	1-2	33,4	1	53,4	2
3.	Boyovut	Alp-Jamol	7,0	2,0	2	22,3	1-2	34,3	1	61,6	2
4.		Zur ziyokor	9,2	1,1	1	32,1	2-3	27,6	1	45,3	2
5.	Oqoltin	Agro Oqoltin ko'rki	5,1	2,7	2	22,0	1-2	25,3	1	42,4	2
6.		Ulug'bek Shirin Sharof	16,0	0,9	1	22,8	1-2	23,2	1	65,3	2
7.	Sardoba	Oqqayin	9,1	1,5	1	35,1	2-3	28,5	1	45,2	2
8.		Qo'shchinor do'stlik eri	10,3	1,7	2	24,8	2-3	31,6	1	47,3	2

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