Wheat thrips (*Haplothrips tritici* Kurd.) damage on grain crops in Uzbekistan

Marat Abdillayev[1,*] and *Qalandar* Bababekov[1]

[1]Research Institute of Plant Quarantine and Protection, Tashkent, 100003, Uzbekistan

Abstract. This article provides comprehensive insights into the detrimental impact of wheat thrips, a widespread and persistent pest that affects wheat crops within our country. The research delves into the conditions under which wheat thrips cause substantial harm to crops, taking into account the specific climatic factors present within our region. A comparative analysis of pest prevalence and the resulting damage was conducted between the years 2020 and 2023. The study underscores that wheat thrips infestation leads to significant harm across various growth stages of wheat, spanning from the tillering phase to the maturity phase. Through meticulous investigation, the research reveals that wheat thrips can be found at varying densities, ranging from 5 to 35 thrips per stem within typical agricultural fields. To enhance its content, the article is enriched with tables and images that illustrate the outcomes derived from the research. This visual and data-driven approach amplifies the understanding of the pest's impact, its prevalence, and the associated damage it inflicts upon wheat crops.
Keywords. *Haplothrips tritici Kurd*, wheat, spike, pest, plant, yield, grain, stem, cereals.

1 Introduction

In order to implement the tasks in 2023 which were defined in the strategy of the development of agriculture of the Republic of Uzbekistan for 2020-2030, to increase the volume of food production through effective use of available resources, to ensure the demand of the population in the domestic market and to maintain price stability, and to provide economic and financial support to the producers of agricultural products, the Ministry of Agriculture of the Republic of Uzbekistan and the Council of Farmers and Homestead Land Owners of Uzbekistan have determined that the expected minimum price for 2022 will be 2.5 million soums for 1 ton of grain harvest [1, 2].

In terms of cultivation, wheat is grown on the largest number of agricultural crops in Uzbekistan. In the conditions of Uzbekistan, the optimal period for planting winter wheat is from September 15 to October 15. Planting wheat at the specified time is one of the important factors for increasing productivity. In recent years, as a result of the dry climate, pests leave the hibernation period early and seriously damage grain crops, which has a negative impact on productivity [3, 4].

* Corresponding author: marat.abdillaev1001@mail.ru

It is important to preserve agricultural products and reduce losses. Currently, 42-50% of crop yields are lost by harmful organisms, 9.2-13% of which are caused by pests [5]. In Uzbekistan, during the period of cotton cultivation, the harmful effects of pests on crop yield result in an annual loss of 28-35%. Protecting the crop from these pests is essential, and one effective measure is the proactive control of the damaging cotton thrips [6-8].

Among the significant harmful pests, cotton thrips (*Haplothrips tritici* Kurd.) pose a substantial threat. Their presence has been observed to cause significant damage to the quality and quantity of cotton yield in the Republic over the years. Consequently, the bioecological characteristics, distribution, and levels of damage caused by cotton thrips have been investigated in Uzbekistan. These pests, belonging to the family Pleothripidae within the order Thysanoptera, specifically target reproductive organs, causing damage to floral structures and deformations [9].

Wheat thrips (*Haplothrips tritici* Kurd.) is a very common and dangerous pest among thrips that seriously damages grain crops. This phyphophagous pest appears in the tillering phase of wheat and can be seen in the flowering phase when the number of thrips in the spike is the highest rate, first the larvae of thrips damage the husk of the spike and then the grain. If there are 40-50 thrips in the spike of wheat during the spike formation phase, the grain yield decreases by 0.18-0.25 t/h [10].

Wheat thrips is one of the most common and dangerous pests of winter and spring wheat. The thrips feeds on the cell sap of wheat, resulting in a sharp decrease in the photosynthesis process in the spike and leaf of wheat and grain yield. Thrips larvae feed directly on the spikelet and grain, reducing grain weight and resulting in reduced yield [2, 10].

When subjected to infestation by cotton thrips, the plants suffer from damage to their flowers, resulting in bud abortion, weakening of shoots, and deformations of the plant structure. Infested cotton bolls show reduced starch and sugar content, decreased levels of protein-bound amino acids, and an increase in free amino acid [11].

Early pests of wheat plants cause infertility of wheat flowers, thinning of spikes and deformation of grain shape. In damaged grains, the amount of starch and sugar decreases, the amount of protein amino acids decreases, and the number of free amino acids increases [3]. Thrips larvae that emerge from the first hibernation initially feed on the ear band, flower husks, ovary, and developing grain, resulting in "over grain" in wheat spikes. In the second stage, the larvae accumulate in the groove of the grain and cause a change in the shape of the wheat grain and loss of grain weight [4].

In wheat, larvae of wheat thrips are more harmful than adults. As soon as the larvae hatch, they immediately begin to damage the ear band and the calyx. After the tissues of this part of the spike thicken, the larvae begin to suck the grain [6]. The adult of wheat thrips is not limited to damaging the vegetative organs of wheat. While the larvae, especially in dry years of the climate, decrease the weight and composition of the grain in the spike by entering the spikes, flower husks, sometimes inside the flower and sucking the grain juice [7].

2 Materials and methods

In our research, we used widely accepted textbooks of practical training in general and agricultural entomology, as well as general monographs [1-3]. To determine the types of thrips in the obtained samples, they were kept in fixatives made from a mixture of 5% formalin, alcohol and 4% glycerin until the species was determined by the specialists. These works were carried out according to methodological guidelines [4-6].

Research was conducted under laboratory, small field and production conditions, and experiments on wheat thrips damage were conducted under lysimeter conditions. For this, each lysimeter was individually covered with a white cloth of 120 cm x 80 cm. As a control was taken a lysimeter covered with the same cloth, but not infested with wheat thrips.

Experiments were triplicated. Thrips were artificially released on the wheat inside the cloth by 3; 5; 8 pieces per ear. Pests were released on the wheat in three different periods: tillering, spiking and milk ripening stages and they were counted every five days. The phenological development of damaged and undamaged plants, their weight and the quality of the crop were observed and studied.

The damage coefficient of the lost yield in the damaged plant was shown in percentages and was expressed according to Belyaev. Counting the insects in field conditions was carried out [3]. In this case, adult insects in the field were counted each time by shaking 20 times 5-10 places of the field with the help of an entomological handle during the periods of tillering and spiking. At the beginning of the grain formation period, the spikes were cut in different parts of the field and the larvae were counted separately in each spike.

The amount of gluten in flour obtained from damaged and undamaged grains was determined [6, 9].

3 Results and discussion

Based on the climatic conditions of different regions of Uzbekistan, observations of our research were made on the prevalence and damage caused by the wheat thrips.

The research was carried out mainly in the regions Tashkent, Sirdarya, Jizzakh, Samarkand, and Kashkadarya in the form of monitong. The research was carried out from 2020 to 2023, the prevalence and damage of pest of grain crops – wheat thrips was studied.

Table 1. Monitoring of the prevalence and damage of wheat pests in different regions of Uzbekistan *(Monitoring of the laboratory for the control of harmful organisms of grain and legume crops, 2022).*

#	Provinces	Districts	Pest prevalence, %
			Wheat thrips
1	Tashkent	Kuyi Chirchik and Kibray districts	40%
2	Sirdarya	Guliston and Sardoba districts	35%
3	Jizzakh	Sharof Rashidov, Pakhtakor, Gallaorol districts	33%
4	Samarkand	Ishtikhon, Urgut, Taylok, Bulungur, Payarik, Okdaryo, Pastdargom districts	29%
5	Kashkadarya	Kitob, Shakhrisabz, Yakkabog, Kasbi, Karshi districts	32%

We mainly conducted research in the grain fields of clusters and farms in the central and partly southern regions of the country (2020-2023).

As a result of damage to wheat by wheat thrips, the biochemical composition of the grain in the spike changes, and the amount of protein, minerals and gluten decreases sharply. In our research, it was found out that in a plant infected with wheat thrips, the shape of the spike is small, the grain groove is enlarged, and the affected grains are smaller compared to the healthy grain, and the nutritional value of such grains decreases (Tables 2 and 3).

Table 2. Wheat thrips infection at different developmental stages of wheat (Experimental site of PQPRI, in 2021).

#	Phases	Thrips number per spike, pcs	Number of stems per plant, pcs	Mean length of stem, cm	Spiking level, %	Spike length, cm	Number of grains per spike, pcs
1	Tillering	3	6.2	89.7	94.1	8.3	40.7
		5	6.1	89.3	92.3	7.9	40.3
		8	5.9	88.1	92.0	8.2	39.1
2	Spike formation	3	6.4	90.9	95.9	8.4	43.1
		5	6.2	90.1	95.7	8.2	42.3
		8	6.0	89.5	94.5	8.0	41.1
3	Milk maturity	3	6.6	91.5	96.8	9.0	46.9
		5	6.4	91.3	96.3	9.5	47.3
		8	6.2	90.4	95.5	8.9	46.1
4	Control (undamaged)	-	6.7	92.3	97.2	9.6	46.8

Table 3. Yield reduction in wheat thrips infection at different developmental stages of wheat (Experimental site of PQPRI, in 2021).

#	Phases	Thrips number per spike, pcs	Weight of 1000 grains, gr	Yield per plant, gr	Yield reduction compared to control	
					g/plant	%
1	Tillering	3	36.1	6.6	1.4	17.5
		5	34.5	6.1	1.9	23.7
		8	35.0	4.8	3.2	40.0
2	Spike formation	3	41.5	7.3	0.7	8.7
		5	38.4	6.9	1.1	13.7
		8	39.9	5.8	2.2	27.5
3	Milk maturity	3	46.3	7.9	0.1	1.2
		5	45.6	7.8	0.2	2.5
		8	43.4	7.7	0.3	3.7
4	Control (undamaged)	-	47.5	8.0	0	0

Based on the results of our scientific experiments, it can be said that when wheat is 100% damaged by thrips, the criterion for causing economic damage is 5 thrips per plant during the tillering period, and 8 thrips per plant during the spiking period. In these phases, if the number of thrips exceeds the specified amount, it is a good time to start protective and control measures.

The earlier grain crops are affected by wheat thrips and the denser their numbers, the greater the yield loss. In the period of tillering of wheat, 3 thrips on one plant causes more than 20.0% yield loss, while 5 thrips on one plant causes yield loss of up to 12.8%. Even when there are more than 8 thrips per plant during the milk maturity period, it does not significantly affect the yield.

The criterion of economic damage is the most favorable time to initiate protective measures, when the degree of damage to the plant or the density of the pest population can cause significant damage to the harvested crop. Correctly defining the criterion of causing economic damage allows us to avoid inappropriate and unjustified chemical treatment (Figure 1).

Figure 1. Field experiment lysimeter to determine damage caused by wheat thrips (2021).

The above pictures show the experiments carried out in the lysimeter experimental field of the Plant Quarantine and Protection Research Institute. In this experiment, wheat thrips was brought from the grain fields, and was artificially infested on the winter wheat planted in our lysimeter experimental field, and the damage caused to the wheat was determined. Morphological changes in the spike and grain under the influence of wheat thrips damage were analyzed in the laboratory (Figure 2).

Figure 2. Field experiments to determine wheat thrips (2021).

4 Conclusions

During the research, it was found that the wheat thrips was found in all the studied regions and caused damage to the grain crops. When analyzing the distribution of wheat thrips in regions, it was found that thrips is most widespread in Tashkent region. In our experiments, it was found that the number of wheat thrips in 1 plant was 5-12 pieces in the areas where wheat thrips is rare, and up to 35 wheat thrips in the spike of the plant in areas where wheat thrips were widespread.

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