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SEASONAL MONITORING OF THE COTTON BOLLWORM *HELICOVERPA ARMIGERA* Hbn. BY USING LIGHT TRAPS

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KEYWORDS

Generations *Helicoverpa armigera Hbn*
Luminescent trap
Monitoring
Population

ABSTRACT

The present study presents the results obtained from the seasonal control of the *Helicoverpa armigera* Hbn pest using light traps. From the research conducted during the growing season of agricultural crops in the years 2021-2022, it was found that light traps can be successfully utilized in seasonally controlling the number of generations and reducing the population of the *H. armigera* Hbn pest under the agroclimatic conditions of the Republic of Moldova.

INTRODUCTION

Approximately 80% of the total agricultural crop pests consist of insects, both during the growing season and the harvesting and storage periods (Tkach, 1977).
Within the class Insecta, the order Lepidoptera is one of the most numerous, comprising around 140,000 species. Out of this total, approximately 25000 species are attributed to the family Noctuidae (Piccardi et al., 1977).
Until now, in the Republic of Moldova, around 300 species belonging to this family have been identified. However, the most economically important ones are the species with a hidden lifestyle, such as the *Helicoverpa armigera*. The females of this species are prolific, laying about 500-1000 eggs, with a maximum of up to 3000 eggs. The distribution range of this phytophagous insect is wide, ranging from the Atlantic Ocean to the Indian and Pacific Oceans.
This species annually causes substantial damage to agricultural crops throughout the territory of the Republic of Moldova. Its larvae are known as "fruit borer moths" and exhibit a high level of polyphagy, attacking a wide range of cultivated plants. The most significant losses are recorded in crops of high economic importance such as corn, sunflower, soybeans, tomatoes, and other agricultural crops (Sukhareva, 1999).
A viable solution for ensuring food security and environmental improvement could be the widespread implementation of advanced technologies, including methods for monitoring pest development (Piccardi et al., 1977).
The development of the population of the fruiting borer pest *H. armigera* in the specific agroclimatic conditions of the Republic of Moldova, by using light traps.

MATERIALS AND METHODS

All the research conducted during these two years, 2021-2022, was carried out on the experimental fields of the Institute of Genetics, Physiology, and Plant Protection of USM. The main crops during these two years of research were: soybeans, sunflowers, tomatoes and corn. The research consisted of seasonal collection and recording of the imago stage of *H. armigera*, attracted by light traps. The staple crops during these two years of research were.
Light traps were developed within the IGFPP of USM. Technical characteristics of the light installation: power source – 220 V, 12 V; nominal power – 8 W; recommended radiation source – UV T5 BLB type lamp; wavelength - 365 nm; operating time – approximately 3000 hours; overall dimensions – 700 x 450 x 450 mm; weight - up to 3 kg (Figure 1).

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a b

Figure 1. Light trap (a) and division of biological material collected by species and gender (b)

The light traps were placed at a height of about 2 m from the ground. The collection of the biological material captured in the collectors, the record, and the replacement of the collector was carried out daily during the entire vegetation period. In laboratory conditions, the collected biological material was subjected to species division.

RESULTS AND DISCUSSION

Following the analysis of data obtained through seasonal collection of biological material from light traps over a two-year period, it was found that the total number of *H. armigera* moths amounted to 3072 individuals. This finding demonstrated that the population density of this pest was quite significant, leading to economically significant damage to agricultural crops. Based on the obtained data, it can be observed that the population density of the pest can vary from year to year depending on climatic factors. Thus, over the two years of monitoring, it was found that the highest population density of *H. armigera* moths occurred during the growing season of 2022. Approximately 2656 adult moths were attracted to the light traps during this year, representing an 86% increase compared to the number of individuals attracted in 2021. It can be noted that the sum of effective temperatures for the development of the *H. armigera* population in 2022 was 228 degrees Celsius. Leading to a massive flight to the light traps. Temperatures during the growing season of 2021 were lower than those in 2022. In the Republic of Moldova 2021. The average annual air temperature in the area was +8.9 to +11.4ºC. The absolute maximum air temperature reached +37ºC. The absolute minimum was -21ºC (Figure 2) (https://www.meteo.md/index.php/meteo/arhiva/arhiva-anilor/).

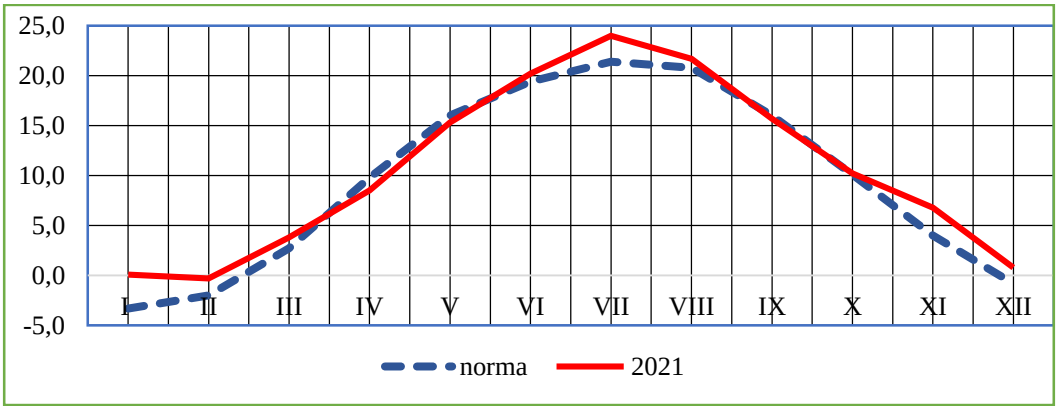

Figure 2. Average monthly air temperature, SM Chisinau 2021

The average annual air temperature 2022 ranged from +10,2… +12,6ºC, the absolute minimum air temperature for the year was -13,6ºC. The absolute maximum reached +37°C (Figure 3)
(https://www.meteo.md/index.php/meteo/arhiva/arhiva-anilor/).

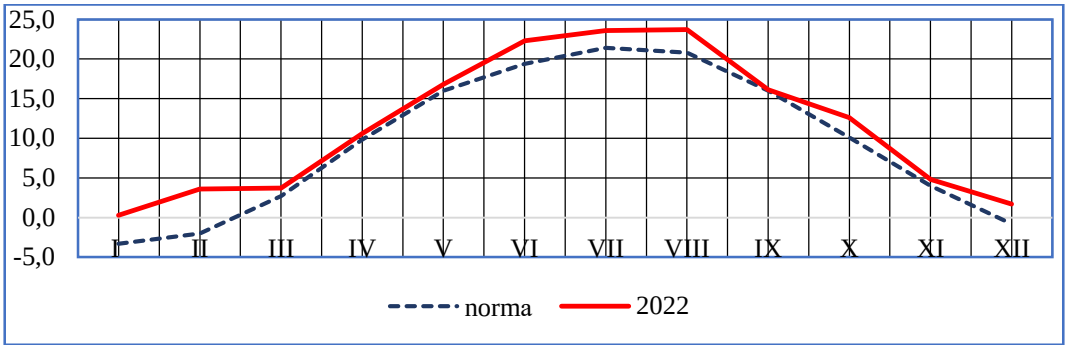

Figure 3. Average monthly air temperature, SM Chisinau 2022

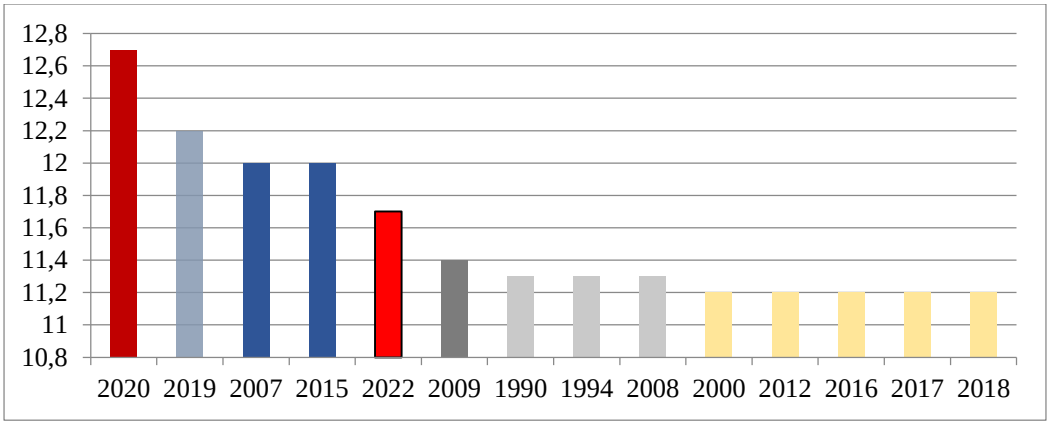

Figure 4. The sequence of years with high average temperatures

During the growing season of 2022, the maximum number of *H. armigera* adults attracted to light traps was recorded in the third decade of August, totaling 1670 individuals. After being divided by gender, it was found that 1028 of these were males and 642 were females, resulting in a sex ratio of ♀ to ♂ of 0.6:1.6 (Table 1).

Table 1. Monitoring the *H. armigera* flea population by applying light traps during the 2021-2022 vegetation period (IGFPP of USM experimental fields)

Month	Decade	The year			
		2021		2022	
		♀	♂	♀	♂
May	I	0	0	1	0
	II	0	0	1	2
	III	0	0	2	2
Total		**0**	**0**	**4**	**4**
June	I	0	1	1	9
	II	0	1	1	10
	III	4	7	5	10
Total		**4**	**9**	**7**	**29**
July	I	1	5	2	4
	II	6	13	25	21
	III	1	1	15	51
Total		**8**	**19**	**42**	**76**
August	I	1	14	67	46
	II	24	6	89	48
	III	65	43	642	1028
Total		**90**	**63**	**798**	**1122**
September	I	27	73	108	306
	II	37	75	28	26
	III	0	11	43	22
Total		**64**	**159**	**179**	**354**
October	I	0	0	13	28
	II	0	0	0	0
	III	0	0	0	0
Total		**0**	**0**	**13**	**28**
TOTAL		**416**		**2662**	

During the same period in 2021, only a total of 108 adult specimens of *H. armigera* were recorded as attracted to the light traps. The analysis of the obtained results demonstrates that the population density of *H. armigera* during the corresponding period in 2021 was approximately 15 times lower compared to 2022 (Table 1).

The analysis of the results obtained during the research conducted over the two-year period has allowed us to conclude that light traps are an effective means of controlling the development of the *H. armigera* pest. Thus, it was observed that in 2021, the first adult specimens appeared starting from the first decade of June and the population development continued until the second decade of September.

The climatic conditions of the year 2022 resulted in the flight of the first adult *H. armigera* specimens being recorded approximately one month earlier, starting from the first decade of May and lasting until the second decade of October. This represents a one-month extension of the flight period compared to 2021 (Figures 5, 6).

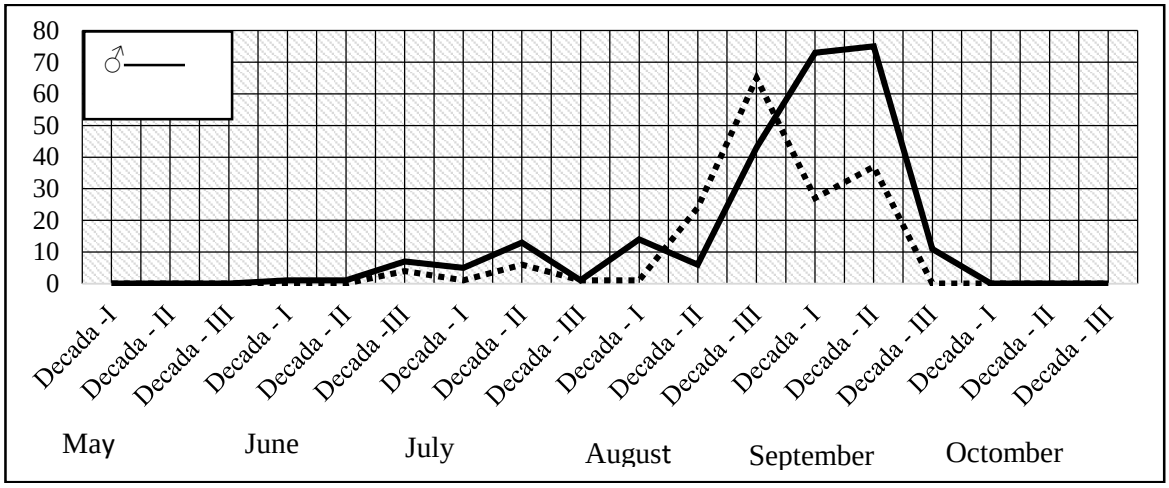

Figure 5. Seasonal control of the development of the *H. armigera* population during the vegetation period of 2021 by applying light traps (the experimental fields of the IGFPP of USM)

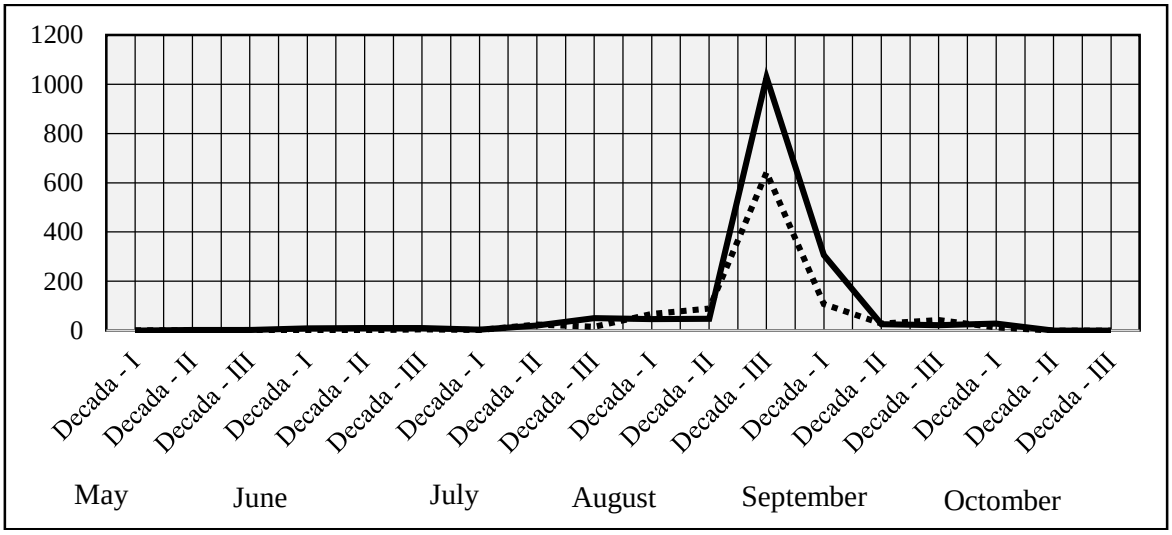

Figure 6. Seasonal control of the development of the *H. armigera* population during the vegetation period of 2022 by applying light traps (the experimental fields of the IGFPP of USM)

Additionally, it was found that in 2022, the flight of the first adults of the first generation of *H. armigera* began in the first decade of May and continued until the second decade of August, with a total of 323 specimens attracted to the light traps. In contrast, in 2021, the flight of the first adults of the first generation started only in the first decade of June and continued until the second decade of August, with a total of 85 specimens attracted to the light traps. The imago flight in the second generation starting from the second decade of August and lasted until the first decade of October with a total number of about 88% higher than in the first generation of the year 2022.

The flight of adults from the second generation was observed starting from the second decade of August and lasted until the first decade of October, with a total number of specimens approximately 88% higher than in the first generation of 2022. Therefore, the results obtained over two years of vegetation monitoring suggest that light traps can be successfully applied as a methodological element for monitoring the development of the *H. armigera* population and assessing population density in the agroclimatic conditions of the Republic of Moldova.

CONCLUSION

Following the research conducted during the growing season of agricultural crops in 2021-2022 using light traps, it was found that the use of these traps can serve as a successful methodological element in controlling the number of generations as well as reducing the population of the *H. armigera* pest.

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