RESEARCH ON THE FLIGHT DYNAMICS OF *HELICOVERPA ARMIGERA* HÜBNER IN MAIZE CROPS FROM THE TRANSYLVANIAN PLATEAU

Adina-Daniela TĂRĂU[1], Camelia URDĂ[1], Ana-Maria VĂLEAN[1], Felicia MUREȘANU[2], Laura ȘOPTEREAN[1], Loredana SUCIU[1], Florin RUSSU[1], Felicia CHEȚAN[1]

[1]Agricultural Research and Development Station Turda, Romania
[2]Academy of Agricultural and Forestry Sciences "Gheorghe Ionescu-Șișești", Bucharest, Romania

INTRODUCTION

Helicoverpa armigera Hübner (Lepidoptera: *Noctuidae*) is one of the most important pests of maize crops, with a wide geographical distribution and a high capacity to adapt to different climatic conditions. Through the activity of its larvae, the species causes direct damage to the female and male inflorescences, and indirectly promotes fungal infections, leading to significant economic losses. Under the pedoclimatic conditions specific to the Transylvania Plateau from Romania, information regarding the population dynamics of *Helicoverpa armigera* is limited, indicating the need for local studies to support the integrated pest management strategies.

Monitoring adult flight represents an essential step, as it provides the basic information needed to make accurate decisions regarding the timing and type of interventions, thereby preventing yield losses and reducing control costs. One of the most effective methods is the use of pheromone traps. The aim of the study is to assess the relationship between climatic conditions and the flight dynamics of *Helicoverpa armigera* in maize crops from the Transylvanian Plateau, in order to optimize monitoring systems.

Figure 1. Maize ear damage caused by *Helicoverpa armigera* larvae (original)

MATERIAL AND METHODS

In order to achieve this objective, a study was carried out at the Agricultural Research and Development Station (SCDA) Turda during the period 2022–2024, using FUNNEL-type pheromone traps installed in maize crops. The experimental data regarding the abundance and flight dynamics were statistically analyzed using polynomial regression, based on the main climatic variables: minimum temperature, maximum temperature, relative air humidity, and minimum air humidity. The calculated statistical indicators included: the mean absolute error (MAE), the root mean square error (RMSE) and the coefficient of determination (R^2).

Figure 2. FUNNEL-type pheromone trap

RESULTS AND DISCUSSIONS

Table 1

Climatic conditions during the monitoring period of *Helicoverpa armigera* adults, Turda 2022–2024

Month		Minimum temperature (°C)			Maximum temperature (°C)			Relative air humidity (%)			Minimum air humidity (%)		
		2022	2023	2024	2022	2023	2024	2022	2023	2024	2022	2023	2024
May	I	11,6	11,8	11,9	23,6	26,2	23,5	67,0	64,4	69,3	50,8	52,1	51,5
June	I	14,0	13,1	14,3	26,8	26,8	27,5	69.7	72,2	72,4	56,9	48,9	51,8
	II	13,6	13,6	14,6	27,5	23,7	27,4	61,6	82,9	69,1	44,2	66,7	52,7
	III	15,0	14,3	17,9	30,8	26,6	31,6	49	75,6	65,9	31,0	61,3	43,8
July	I	16,7	15,5	16,0	31,4	28,9	29,6	61,4	70,7	64,0	39,6	53,9	50,2
	II	13,4	17,0	19,6	28,8	31,2	36,0	46,2	67,9	55,5	27,5	51,7	33,7
	III	17,9	14,5	15,8	33,1	28,2	29,2	48,3	74,5	59,4	32,0	54,0	43,8
August	I	16,3	14,2	15,4	14,5	13,0	14,1	60,5	73,2	64,7	39,3	57,3	44,1
	II	15,8	15,2	17,8	31,3	30,0	34,0	61,2	64,8	54,7	37,2	45,1	34,1
	III	16,3	16,7	16,2	30,0	31,9	31,5	72,3	70,5	51,7	49,9	51,5	34,0
September	I	13,4	11,9	14,3	22,9	26,6	29,1	87,8	68,2	45,8	71,4	49,1	29,4
	II	10,2	13,8	11,2	19,9	27,0	21,5	79,2	75,3	75,6	64,7	56,5	57,8
	III	8,2	12,5	9,8	18,4	27,2	23,8	83,2	68,5	62,9	67,6	45,4	45,3
October	I	7,7	7,35	-	19,3	20,31	-	80,1	68,9	-	59,5	50,0	-

Source of primary data: Turda meteorological station (longitude: 23 ° 4´; latitude: 46 ° 35´; altitude: 427m)

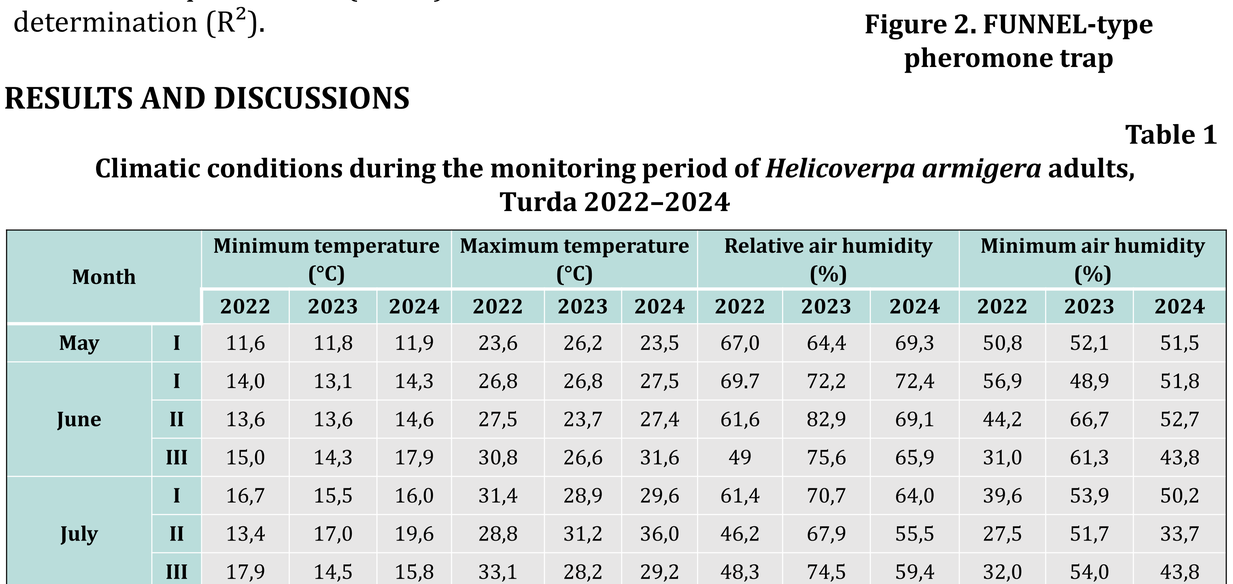

Figure 3. Flight dynamics *of Helicoverpa armigera* Hübner adults in maize crops, Turda 2022–2024

Table 2

Statistical indicators of *Helicoverpa armigera* adults, Turda 2022–2024

Year	Mean absolute error (MAE)	Root mean square error (RMSE)	coefficient of determination (R^2)
2022	2	2.75	0.94
2023	1	1.77	0.92
2024	3	4	0.96

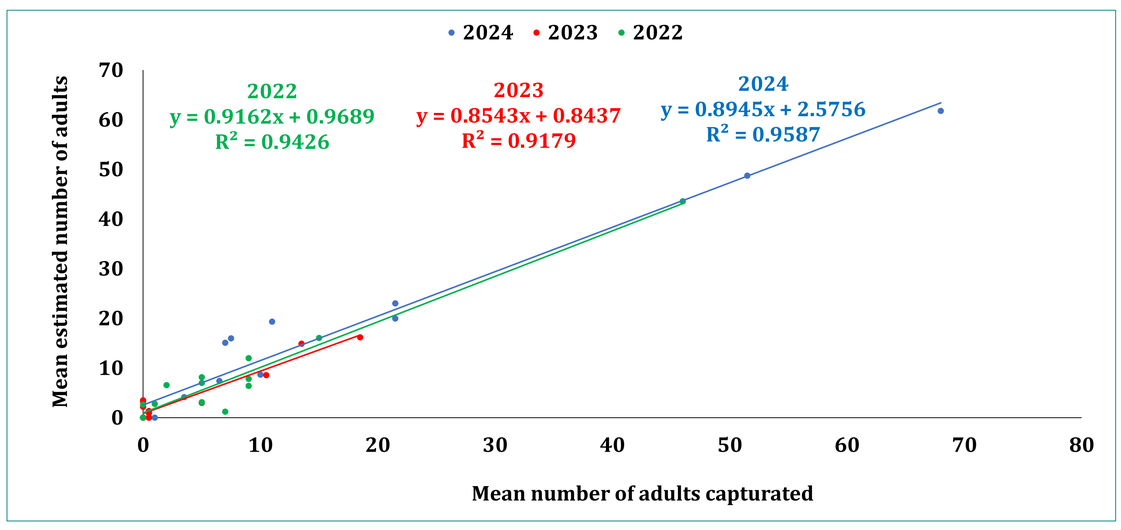

Figure 4. Captured vs. estimated mean number of adults - polynomial regression, Turda 2022-2024

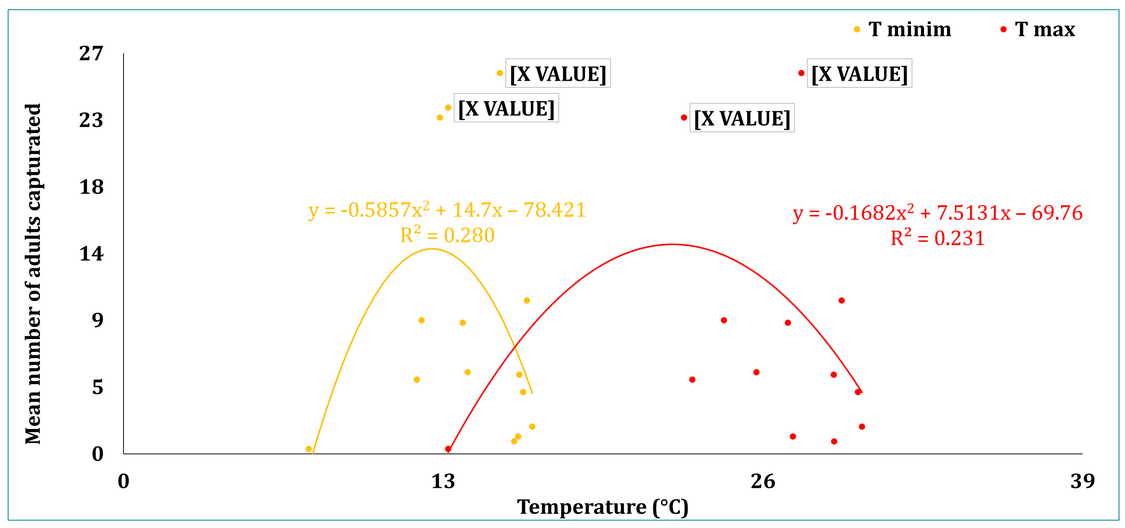

Figure 5. Thermal regime (min/max temperatures) and capture dynamics of *Helicoverpa armigera*, Turda 2022–2024

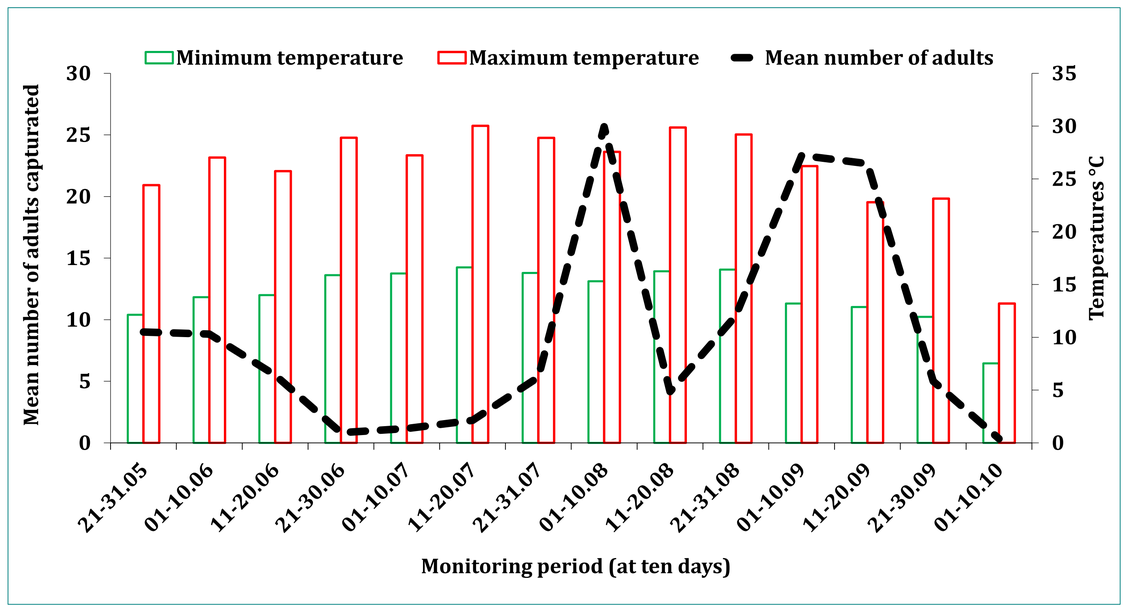

Figure 6. Flight dynamics of *Helicoverpa armigera* vs. temperature, Turda 2022–2024

CONCLUSIONS

- ✓ In 2024, due to higher temperatures and drought conditions, a marked increase in the abundance of *Helicoverpa armigera* adults was observed, with distinct flight peaks occurring in August and September.
- ✓ The high values of the determination coefficients (R^2 = 0.91–0.95) confirm the influence of the analyzed climatic parameters on the flight dynamics of *Helicoverpa armigera*. The year 2023 recorded the smallest error (MAE = 1), while due to the high temperatures in 2024, the largest variations were observed (RMSE = 4).
- ✓ The thermal regime significantly influences the flight activity of Helicoverpa armigera adults, with optimum conditions observed at minimum temperatures of 13–15°C and maximum temperatures of 23–28°C. When temperatures exceed 30°C, adult abundance declines, suggesting a negative impact of high temperatures on the development and activity of the species.
- ✓ High relative humidity negatively affected catches in 2022 and 2024, whereas lower minimum humidity, typical of dry periods, had a positive influence in most years.
- ✓ These results highlight the importance of climatic conditions in population dynamics. Based on the four analyzed climatic parameters, warning bulletins can be developed to support the adoption of the most appropriate management decisions.