# INVESTIGATIONS CONCERNING THE SPREADING, BIOLOGY, ECOLOGY AND CONTROL OF AMERICAN BOLLWORM (*HELICOVERPA ARMIGERA* HB.)

# CERCETĂRI PRIVIND RĂSPÂNDIREA, MORFOLOGIA, BIOLOGIA ŞI ECOLOGIA OMIZII CAPSULELOR (*HELICOVERPA ARMIGERA* HB.)

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***Abstract:*** *We present data concerning the monitoring with aid of the with pheromone traps of American bollworm (Helicoverpa armigera Hb.). in Timis County and also the results regarding the biometric measurements of some adults and larvae populations, the development stages duration, flying curve of adults, the climatic the factors and the natural enemies influence on insect evolution. The pest attacked maize fields from Didactic Station Timisoara. The investigations are new for South-West of Romania and complete the results obtained by the researchers from Vojvodina (Serbia) and Hungary.*

***Rezumat:*** *Sunt prezentate date privind monitorizarea cu ajutorul capcanelor feromonale a omizii capsulelor (Helicoverpa armigera Hb.) în judeţul Timiş precum şi rezultatele privind măsurătorile biometrice ale unor populaţii de adulţi şi larve, durata stadiilor de dezvoltare, curba de zbor a adulţilor, influenţa factorilor climatici şi a duşmanilor naturali asupra evoluţiei insectei. Dăunătorul a atacat culturile de porumb de la Staţiunea Didactică Timişoara. Cercetările sunt noi pentru Sud-Vestul României şi completează rezultatele obţinute de cercetătorii din Vojvodina (Serbia) şi Ungaria.*

***Key words*****:** *Helicoverpa armigera, spreading morphology, biology, ecology*
***Cuvinte cheie***: *Helicoverpa armigera, răspândire, morfologie, biologie şi ecologie*

## INTRODUCTION

American bollworm (*Helicoverpa armigera* Hb.) is a polyphagous pest which in the West Plain conditions attacked frequently the maize cultivations. The insect is in continuous expansion in the South West of Romania.

*Helicoverpa armigera* Hb. was reported in the neighbouring countries, Bulgaria (Popov et all. 1961-1968), Serbia (Sekulići et all. 1995, Čamprag et all. 2004, Vajgand et all. 2004, Čamprag and Jovanić, 2005), Hungary (Mészáros, 1998). In Romania exists scarce and disparate data concerning this pest (Manolache et all. 1949-1961, Cristea et all. 2004, Andru 2004).

In this context the paper presents new data for Romania concerning the cotton bollworm spreading, morphology, biology and ecology.

## MATERIAL AND METHODS

The investigations were carried out in 2005 and 2006 at the University of Agricultural Sciences and Veterinary Medicine of the Banat Timişoara in and Didactic Station Timişoara.

Monitoring was effected by periodic investigations of Timiş County maize fields and especially by aid of pheromone traps Csalomon W.A.R.L. The results were noticed from three in three days.

The biometric measurements were effected on 35 adults and 76 larvae in 2005 and on 76 adults and 42 larvae in 2006.

Researches concerning the pest biology and ecology were made in June-October period in the laboratory conditions, concerning the larval and pupal development duration. In field conditions was studied the larval and pupal duration stage, the larval and pupal first, maximum and latest reports, the adults flying period the populations dynamics. Was also studied the some climatic factors influence on the insect development and also was noticed the natural enemies.

## RESULTS AND DISSCUSSIONS

In 2005, *Helicoverpa armigera* Hb. was identified in maize cultivations from 18 localities from Timiş County and in 2006 from 21 localities. (Figure 1)

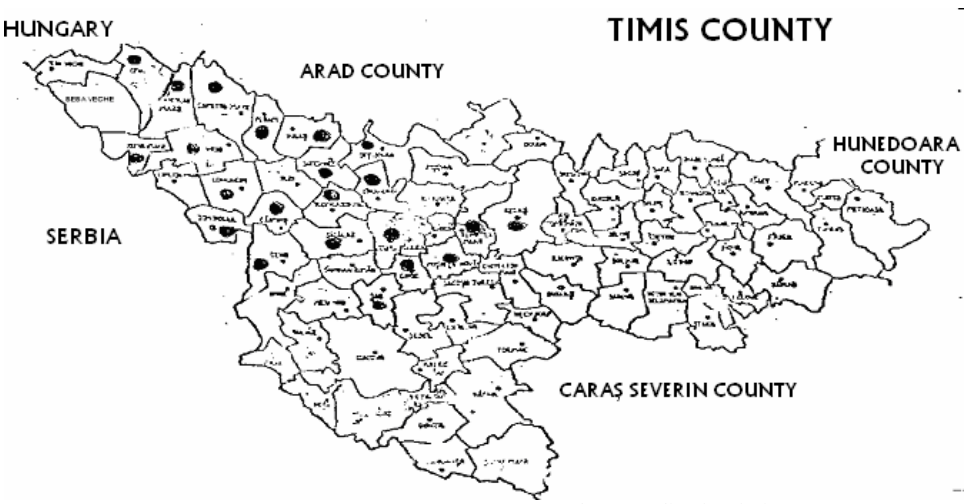


Figure 1. American bollworm (*Helicoverpa armigera* Hb.) spreading in Timiş County 2006

The pest was ascertained in 2005 especially along the border with Serbia and Hungary but in 2006 it spread also in the East of Timiş County near Lugoj.

The larval body length of the young larvae is 5.55±1.08, of the middle aged larvae is 18.09±0.792 and of mature larvae is 29.63±1.35. The larval cephalic capsule diameter for young larvae 0.5 mm for middle aged larvae is 5.5±1.08 mm and for mature larvae is 2.342±0.094 (Table 1).

*Table 1*

Body length and cephalic capsule diameter of the *Helicoverpa armigera* Hb. Larvae

| Larval age | Larval body length (mm) | Mean (mm) | Cephalic capsule diameter (mm) | Mean (mm) |
|---|---|---|---|---|
| Young larvae (I-II) | 2.0 -10.0 | 5.55±1.08 | 0.3-0.5 | 0.5 |
| Middle aged larvae (III-IV) | 11.23-23.00 | 18.09±0.792 | 0.6-1.5 | 1.375±0.065 |
| Mature larvae (V-VI) | 24.00-40.00 | 29.63±1.35 | 1.6-3.0 | 2.342±0.094 |

The wing expanse of adults was in mean 37.263±0.087 and the body length is in mean 18.565±0.0106 (Table 2).

*Table 2*

Wing expanse and body length of *Helicoverpa armigera* Hb. Adults

| No. | Wing expanse (cm) | Body length (cm) | No. | Wing expanse (cm) | Body length (cm) |
|---|---|---|---|---|---|
| 1 | 3.0 | 1.5 | 38 | 3.8 | 1.8 |
| 2 | 3.0 | 1.5 | 39 | 3.8 | 1.7 |
| 3 | 3.5 | 1.6 | 40 | 3.8 | 2.0 |
| 4 | 3.5 | 1.6 | 41 | 3.8 | 1.9 |
| 5 | 3.5 | 1.5 | 42 | 3.8 | 1.9 |
| 6 | 3.5 | 1.7 | 43 | 3.8 | 1.8 |
| 7 | 3.5 | 1.5 | 44 | 3.8 | 1.8 |
| 8 | 3.5 | 2.0 | 45 | 3.8 | 1.7 |
| 9 | 3.5 | 1.8 | 46 | 3.8 | 1.7 |
| 10 | 3.5 | 2.0 | 47 | 3.8 | 1.8 |
| 11 | 3.5 | 1.9 | 48 | 3.8 | 1.7 |
| 12 | 3.5 | 1.8 | 49 | 3.8 | 1.9 |
| 13 | 3.5 | 1.9 | 50 | 3.8 | 1.7 |
| 14 | 3.5 | 1.9 | 51 | 3.8 | 1.7 |
| 15 | 3.5 | 1.9 | 52 | 3.9 | 2.0 |
| 16 | 3.5 | 1.7 | 53 | 3.9 | 2.0 |
| 17 | 3.5 | 1.5 | 54 | 3.9 | 2.0 |
| 18 | 3.5 | 1.7 | 55 | 3.9 | 2.0 |
| 19 | 3.5 | 1.5 | 56 | 3.9 | 2.0 |
| 20 | 3.5 | 1.9 | 57 | 3.9 | 2.0 |
| 21 | 3.5 | 1.6 | 58 | 3.9 | 2.0 |
| 22 | 3.5 | 1.8 | 59 | 3.9 | 2.0 |
| 23 | 3.5 | 1.7 | 60 | 3.9 | 2.0 |
| 24 | 3.6 | 1.7 | 61 | 4.0 | 2.0 |
| 25 | 3.6 | 1.8 | 62 | 4.0 | 2.2 |
| 26 | 3.6 | 1.8 | 63 | 4 | 2.2 |
| 27 | 3.6 | 1.8 | 64 | 4.0 | 2.0 |
| 28 | 3.6 | 1.8 | 65 | 4.0 | 2.1 |
| 29 | 3.7 | 1.8 | 66 | 4.0 | 2.2 |
| 30 | 3.7 | 2.0 | 67 | 4.0 | 2.0 |
| 31 | 3.7 | 1.9 | 68 | 4.0 | 2.0 |
| 32 | 3.7 | 1.8 | 69 | 4.0 | 2.0 |
| 33 | 3.7 | 1.8 | 70 | 4.0 | 2.0 |
| 34 | 3.7 | 2.0 | 71 | 4.0 | 2.2 |
| 35 | 3.7 | 1.8 | 72 | 4.0 | 2.0 |
| 36 | 3.7 | 1.8 | 73 | 4.0 | 2.0 |
| 37 | 3.8 | 1.8 | 74 | 4.0 | 2.2 |
| | | X | 37.263±0.087 | X | 18.565±0.0206 |

The dimensions generally correspond with the data from literature but with some peculiarities.

In 2005 on the field conditions *Helicoverpa armigera* Hb. had three generation by year. The larvae of first generation appeared in 15 June, the larvae of second generation appeared in 10 July and larvae of third generation, appeared in 23 August. In 14 October the latest larvae were observed (Table 3).

The adults flying period in 2006, registered by aid of the pheromone traps showed that the fly began in 12 June and finished in 11 October. The maximum number of adults was registered in 24 August-25 September period (Table 4).

*Table 3*

Development of *Helicoverpa armigera* larvae from the maize field S.D. Timişoara

| Generation | First appearances | Maximum | Latest appearances |
|---|---|---|---|
| $G_1$ | 15 VI | 30 VI | 6 VII |
| $G_2$ | 10 VII | 15 VII-3 VIII | 10 VIII |
| $G_3$ | 23 VIII | 3 IX | 14 X |

*Table 4*

Period of adults fly *Helicoverpa armigera* Hb. SD Timişoara 2006

| Date | No. adults Trap 1 | No. adults Trap 2 | Total (CI+CII) | Date | No. adults Trap 1 | No. adults Trap 2 | Total (CI+CI) |
|---|---|---|---|---|---|---|---|
| 22.05.06 | - | - | - | 30.07.06 | 3 | 4 | 7 |
| 26.05.06 | - | - | - | 01.08.06 | 1 | - | 1 |
| 31.05.06 | - | - | - | 03.08.06 | - | 3 | 3 |
| 03.06.06 | - | - | - | 08.08.06 | 4 | 3 | 7 |
| 06.06.06 | - | - | - | 13.08.06 | - | 3 | 3 |
| 9.06.06 | - | - | - | 15.08.06 | 4 | 1 | 5 |
| 12.06.06 | 1 | - | 1 | 19.08.06 | 3 | 4 | 7 |
| 16.06.06 | 1 | - | 1 | 24.08.06 | 15 | - | 15 |
| 19.06.06 | - | - | - | 28.08.06 | 4 | - | 4 |
| 24.06.06 | 2 | 2 | 4 | 01.09.06 | 8 | - | 8 |
| 28.06.06 | 3 | - | 3 | 05.09.06 | 5 | - | 5 |
| 03.07.06 | 2 | 2 | 4 | 11.09.06 | 8 | - | 8 |
| 07.07.06 | - | - | - | 21.09.06 | 45 | - | 45 |
| 10.07.06 | 3 | 2 | 5 | 25.09.06 | 10 | - | 10 |
| 14.07.06 | 2 | - | 2 | 29.09.06 | 5 | - | 5 |
| 19.07.06 | - | - | - | 02.10.06 | - | - | - |
| 22.07.06 | 2 | 4 | 6 | 06.10.06 | 3 | - | 3 |
| 26.07.06 | 4 | 3 | 7 | 11.10.06 | 1 | - | 1 |

The larval population dynamic showed a progressive growth from the third decade of June to the third decade of August den followed by a gradual diminution of the larvae (Figure 2).

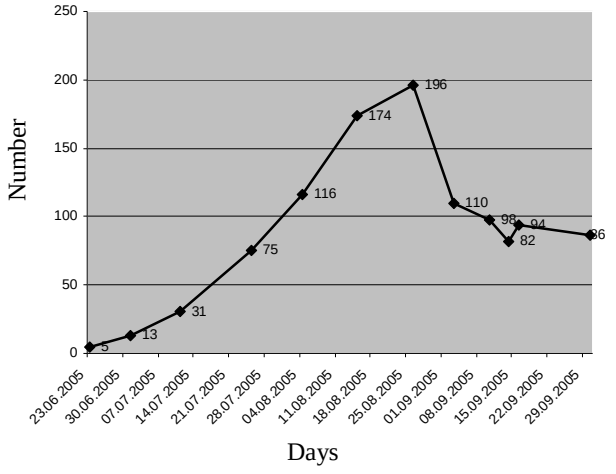


Figure 2. Population dynamics of *Helicoverpa armigera* Hb. larvae S.D. Timisoara 2005

In the laboratory conditions in 2005 the larval stage duration was of 14 days to 25 days and pupal stage of 10 days to 16 days. In 2006 the larval stage duration oscillated from 14 days, to 24 days and pupal stage from 10 days, to 14 days.

The limitative factors of the larval developing the adults apparition and fly for ovoposition in 2005 was the high temperatures and humidity from the end of the July-the beginning of August period. April-August period from 2006 was characterised by high and relative sudden temperature variations associated with high modifications of the precipitations quantities (Table 5).

*Table 5*

Mean monthly temperatures and precipitations in comparison with multiannual means S.D. Timişoara 2006

| Period (month) | | IV | V | VI | VII | VIII |
|---|---|---|---|---|---|---|
| Precipitations (mm) | 2006 | 78.8 | 50.2 | 87.8 | 50.4 | 98.0 |
| | Multiannual mean | 47.2 | 64.9 | 73.5 | 58.4 | 50.3 |
| Differences by normal | Over plus (+) | 31.6 | - | 14.3 | - | 47.7 |
| | Deficit (-) | - | 14.7 | - | 8.0 | - |
| Temperatures ($^{o}$C) | 2006 | 12.4 | 16.2 | 19.5 | 23.6 | 20.1 |
| | Multiannual mean | 11.3 | 16.3 | 19.4 | 21.5 | 20.8 |
| Differences by normal | Over plus (+) | 1.1 | - | 0.1 | 2.1 | - |
| | Deficit (-) | - | 0.1 | - | - | 0.7 |

The high temperatures and a scarce quantity of precipitation in June favourites the first generation of American bollworm development. The number of captured butterfly fluctuations can by correlate with the climatic modifications.

In the maize fields attacked by *Helicoverpa armigera* Hb. were identified some natural enemies from the orders *Hymenoptera, Coleoptera, Neuroptera, Heteroptera*. From predators were determined *Coccinela septempunctata, Adonia variegata (Coccinelidae), Carabus coriaceus (Carabidae), Chrysopa carnea Chrysopidae), Nabis sp. (Nabidae*) and from parasites *Trichogramma sp.(Trichogramatidae), Telenomus sp. (Scelionidae), Habrobracon sp. (Braconidae), Sinophorus sp. (Ichneumonidae)*.

*Helicoverpa armigera* Hb is a relative new pest in maize fields of the Romanian West Plain and in consequence the complex of the specific entomophagous is in extension and in consolidation.

**CONCLUSIONS**

*Helicoverpa armigera* Hb. was ascertained in 2005 from 18 localities of the Timiş County and in 2006 from 21 localities.

Larval body length of the young larvae is 5.55±0.0108 mm, of the middle, aged larvae is 18.09±0.792 mm, and of mature larvae is 29.63±1.35 mm.

Larval cephalic capsule diameter of the young larvae 0.5 mm of the middle aged larvae is 1.375±0.065 and of mature larvae is 2.342±0.094.

The wing expanse of adults is in mean 37.263±0.087 and the body length is in mean 18.565±0.0106.

In field conditions the larvae of first generation a pears in the second decade of June, of the second generation in the first decade of July and for third generation, in third decade of August.

The adults flying period began in the second of June and finished in the second decade of October. Maximum number of adults was registered from the end of August to end of September period.

Larval population's dynamics showed a progressive growth from the third decade of June to the third decade of August.

In laboratory conditions the larvae stage duration in 2005 was of 14-25 days and 2006 of 14-24 days. The pupal stage duration in 2005 was of 10-16 days and in 2006 of 10-14 days.

The pest's evolution can by correlate with climatic variations.

Complex of the specific natural enemies of the *Helicoverpa armigera* Hb. in maize cultivations is in extension and consolidation.

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