

RESEARCH ON THE FLIGHT DEVELOPMENT OF SOME NOCTUIDAE LEPIDOPTERA SPECIES IN THE CENTER OF MOLDOVA CONDITIONS

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Abstract

The *Noctuidae* family, comprises a group of butterfly also named „owl” which larvae are polyphagous pest that attacks the majority of the crops. The greatest damage occurred at cereals, maize, sunflower, sugar beet, grain legumes and technical plants. In the last half century, *Scotia* and *Mamestra* species, were permanent in the entomologists attention, their monitoring was performed by classical methods and by using synthetic sex pheromones. At A.R.D.S. Secuieni were carried out research which resulted in the collection and recording of noctuide adult species, with a light trap. The observations and measurements made during the years 1993 – 2012, have identified seven species of Lepidoptera, popularly called „owl” as follow: *Agrotis segetum* Den. et Schiff., *Agrotis exclamationis* L., *Amathes C – nigrum* L., *Autographa gamma* L., *Mamestra oleracea* L., *Mamestra persicariae* L., *Mamestra W latinum* Huf.. Based on the data obtained from the investigations it was established: the abundance of species for the study area; the start, duration and end of the flight for each species; the flight intensity and time of the peak flight. After the number of adults collected it was found that in the study area the highest abundance was recorded by *Amathes C – nigrum* L. species, followed by *Agrotis segetum* Den. et Schiff. species, and the lowest values of abundance were obtained by *Mamestra oleracea* L. and *Mamestra W latinum* Huf. species.

Key words: *Agrotis segetum* Den. et Schiff., *Agrotis exclamationis* L., *Amathes C – nigrum* L., *Autographa gamma* L., *Mamestra oleracea* L., *Mamestra persicariae* L., *Mamestra W latinum* Huf..

The *Noctuidae* family, comprises a group of butterfly also named „owl” which larvae are polyphagous pest that attacks the majority of the crops. The greatest damage occurred at cereals, maize, sunflower, sugar beet, grain legumes and technical plants, etc. (Bărbulescu and col., 2002; Popov and Mateiaș, 1979; Popov and col., 2007 a, b; Roșca and Pasol, 1997; Roșca and Istrate, 2004; Roșca and col., 1995). The crop plants can be damaged from rising and until 8 – 10 leaves phases. The larvae eat the plants in the neck area, if they are in the early stages of vegetations they dry, in later stages, drill the stem above the neck area and dig galleries in the middle of the stem. In this situation, the central leaf languisheth and gradually the whole plant dries; other times because of the abrasions of the stem, the plants are breaking completely or crooked (Ionescu and col., 1963, 1965, 1966; Popov and Paulian, 1973, 1974; Paulian and Popov, 1968, 1969).

In the last half century, various species of owl from Noctuidae family were continuously monitored by classical methods and by using

synthetic sex pheromones (Roșca and col., 1984; Roșca and col., 1986; Roșca and col., 1995; Roșca and Istrate, 2004).

This paper presents data on the evolution of the species: *Agrotis segetum* Den. et Schiff., *Agrotis exclamationis* L., *Amathes C – nigrum* L., *Autographa gamma* L., *Mamestra oleracea* L., *Mamestra persicariae* L., *Mamestra W latinum* Huf., in Center of Moldova conditions.

MATERIAL AND METHOD

The research were conducted during 1993 – 2012, at A.R.D.S. Secuieni, establishment situated in the SE of Neamt county, between the geographic coordinates of 26°5' east longitude, 46°5' north latitude and at an altitude of 205.7 m above the sea level. The area where the unit is located has a temperate continental climate (D.f.b.x. Köpen), the average annual temperature is 8.7°C and the amount of rainfall is 547 mm.

The research consisted of collecting and recording the adults of seven species from *Noctuidae* family, *Agrotide* genus with the help of a

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light trap. The trap was installed in the experimental field of A.R.D.S. Secuieni, the collections were made daily from 1 April to 31 October. The collected material was sorted, separated by species and recorded in the register..

On the basis of the recorded data have been determined:

- the abundance of species for the study area;
- the start, duration and end of the flight for each species;
- the flight intensity and time of the peak flight.

For the ease interpretation of the obtained results, the 1993 - 2012 period was divided into four stages of five years for each stage.

RESULTS AND DISCUSSIONS

Number of insects collected from light trap during 1993 - 2012 was 6184 specimens of which: 1466 specimens of *Agrotis segetum* Den. et Schiff. species, 1266 specimens of *Agrotis exclamationis* L. species, 1478 specimens of *Amathes C – nigrum* L. species, 955 specimens of *Autographa gamma* L. species, 268 specimens of *Mamestra oleracea* L. species, 457 specimens of *Mamestra persicariae* L. species, and 294 specimens of *Mamestra W latinum* Huf. Species (table 1).

Calculating the percentage of the species, after the number of adults collected, it was found that the seven monitored species were present in the study area in percentage between 4.35% and up to 23.9%. The highest share of 23.9% was recorded at *A. C – nigrum* species, followed by *A. segetum* species with 23.7%, *A. exclamationis* species with 20.5%, *Autographa gamma* species with 15.4%, *M. persicariae* species with 7.4%, *M W latinum* species with 4.75% and *M. oleracea* species with only 4.35% (fig. 1).

Analyzing the evolution of each species for the 1993 - 2012 period it was found that:

- *Agrotis segetum* Den. et Schiff. species was present in the study area each year, the total number of specimens collected was 1466.

The most intense flight occurred in 2007, 2000, 1993, 1994 and 2004 when the annual number of adults collected was between 144 and 102 specimens/trap, and the lowest flight occurred in 1999 and 2002 when the occurrence of the species was sporadic with only 8 and 9 specimens/year (table 2).

Adults flight began in the second decade of April and continued without interruption until the end of the first decade of October. During this time there were recorded two curved flight with the major peak in the third decade of May or the first ten days of June for the first flight, and the second

flight recorded the major peak flight in the first or second decade of August (fig. 2)

- *Amathes C – nigrum* L. species, totaled 1482 specimens and was present in the study area each year during 1993-2012..

The most intense flights, with a number of seizures of more than 100 specimens/year were recorded in 1998, 2005, 2006, 2008 and 2009 and the lowest flight of 4 and 21 specimens/year were recorded in years 2002 and 2012 (table 3).

Adults flight started, in all the years of observation, in the III – th decade of April or the first decade of May and continued without interruption until the end of September or the first decade of October.

During this period from April to October, the *Amathes C - nigrum* L. species conducted in every year two flight curves, with the major peak flight in the first decade of June and the second decade of August, the the second flight was higher intensity compared to the first, the major peak flight was of 53 specimens/phase and up to 164 specimens/stage (fig. 3).

- *Agrotis exclamationis* L. species was recorded in each year and were collected from the light trap on the total period 1266 specimens (table 4).

The largest number of insects were collected in phase III (2003 - 2007) of 484 specimens and in I stage (1993 - 1997) of 478 specimens, in the second and fourth stage the number of adults collected was of 183 respectively 121 specimens.

Adults flight began in the first decade of June, continued until the end of the second decade of September, the insect making two flight curves with a major peak, in the first decade of June and the second decade of August (fig. 4).

- *Autographa gamma* L. species totaled for the entire observation period 955 specimens, was reported in each year, the total number of specimens collected in stages ranged from 166 adults (stage III 2003 - 2007) and 397 adults (stage I 1993 - 1997) (table 5).

Adults flight began in the second decade of April and continued until the end of the first decade of October, the maximum flight curve was recorded in the third decade of July or the first decade of August (fig. 5).

- *Mamestra oleracea* L., *Mamestra persicariae* L. and *Mamestra W latinum* Huf. species showed lower flight intensities, the total number of specimens collected between 1993 - 2012 was 268 specimens (*M. oleracea*), 457 specimens (*M. persicariae*) and 294 specimens (*M. W latinum*) (table 6, 7, 8).

Adults flight began in the second or III decade of April and continued until the end of the first or second decade of September..

During this time the adults of the three species conducted two flight curves with major peaks in the second or third decade of May and the third decade of July or the first decade of August (fig. 6).

CONCLUSIONS

During 1993 – 2013 period, in the Secuieni – Neamț area, were collected from the light trap seven species from *Noctuidae* family, *Agrotidae* genus: *Agrotis segetum* Den. et Schiff., *Agrotis exclamationis* L., *Amathes C - nigrum* L., *Autographa gamma* L., *Mamestra oleracea* L., *Mamestra persicariae* L., and *Mamestra W latinum* Huf..

After the number of adults collected the percentage of the collected species was: *A. C - nigrum* 23.91%, *A. segetum* 23.7%, *A. exclamationis* 20.5%, *A. gamma* 15.43%, *M. persicariae* 7.38%, 4.75% *Mamestra W latinum* and 4.33% *M. oleracea*.

The most intense flights were recorded by the species: *A. C - nigrum*, *A. segetum*, *A. exclamationis* and *A. gamma*, the number of adults collected on the total period was between 955 and 1482 specimens.

The adults flight began in the second or third decade of April and continued without interruption until the end of September or the first days of October.

In the period from April to October the species *A. C - nigrum*, *A. segetum*, *A. exclamationis* conducted two flight curves and the species *A. gamma* one curve flight with major peak in the third decade of July or the first decade of August.

The lowest flights were conducted by *M. oleracea*, *M. persicariae* and *M. W latinum* species, the number of adults collected on the total period was between 268 and 457 specimens.

The adults of *M. oleracea*, *M. persicariae* and *M. W latinum* species conducted every year two flight curves with the major flight peak in the second or third decade of May and in the third decade of July or in the first decade of August.

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Table 1

The number of specimens collected from the light trap during 1993 – 2012

Species	Phase I 1993 - 1997	Phase II 1998 - 2002	Phase III 2003 - 2007	Phase IV 2008 – 2012	TOTAL
<i>Agrotis segetum</i>	445	292	463	266	1466
<i>Agrotis exclamationis</i>	478	183	484	121	1266
<i>Amathes C – nigrum</i>	356	289	488	349	1482
<i>Autographa gamma</i>	392	210	166	187	955
<i>Mamestra oleracea</i>	74	98	80	16	268
<i>Mamestra persicariae</i>	121	75	138	123	457
<i>Mamestra W - latinum</i>	14	65	93	123	294
					6188

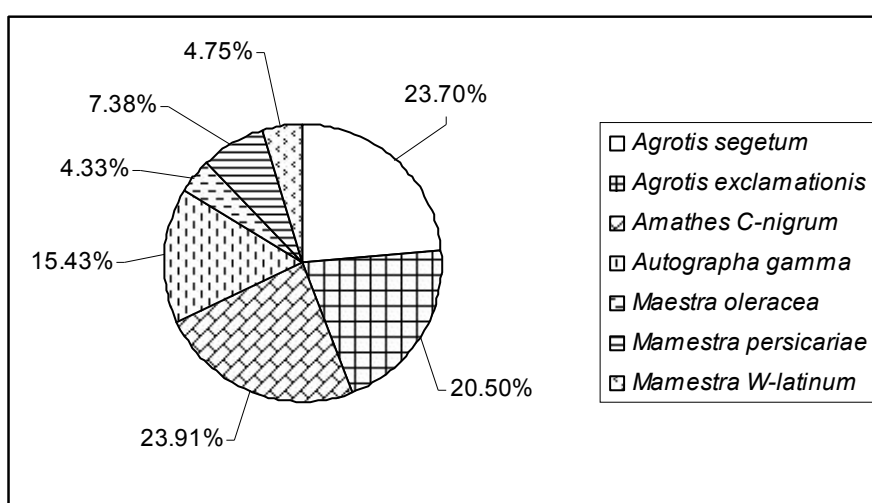


Figure 1. The share of species, depending on the number of insects collected

Table 2
Agrotis segetum

Phase year		Phase I						Phase II						Phase III						Phase IV					
Month	D	1993	1994	1995	1996	1997	Total I	1998	1999	2000	2001	2002	Total II	2003	2004	2005	2006	2007	total III	2008	2009	2010	2011	2012	Total IV
April	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	II	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
	III	0	0	1	0	0	1	6	0	0	0	0	6	2	0	0	0	2	4	2	0	0	0	0	2
May	I	0	0	3	2	0	5	2	0	3	2	3	10	2	2	0	0	3	7	0	1	1	0	0	2
	II	0	14	5	5	1	25	3	0	9	11	1	24	5	8	0	3	13	29	9	9	4	0	0	22
	III	0	20	4	1	4	29	8	0	24	14	4	50	5	16	9	1	28	59	1	7	5	2	1	16
June	I	8	17	0	10	4	39	8	0	9	14	0	31	11	18	5	0	14	48	4	11	16	7	7	45
	II	0	5	3	13	1	22	1	3	3	5	0	12	5	17	6	0	9	37	1	5	11	1	10	28
	III	2	0	0	3	7	12	3	0	2	0	0	5	16	5	1	0	6	28	0	11	0	4	2	17
July	I	1	0	7	9	14	31	4	0	9	3	0	16	6	3	4	0	3	16	0	6	2	0	2	10
	II	5	0	0	2	3	10	7	0	3	3	0	13	26	1	7	0	5	39	0	2	2	0	3	7
	III	13	6	11	4	2	36	16	4	8	1	0	29	1	1	12	0	2	16	0	8	1	0	6	15
August	I	50	20	17	1	9	97	9	1	13	1	0	24	0	8	22	0	4	34	0	13	9	2	4	28
	II	18	8	20	2	4	52	12	1	13	8	0	34	0	14	10	13	18	55	5	9	5	9	2	30
	III	9	8	19	13	0	49	8	0	1	5	0	14	7	5	15	8	11	46	1	11	0	4	1	17
Septem.	I	4	7	4	4	1	20	0	0	0	5	0	5	9	2	0	3	9	23	2	0	0	1	5	8
	II	5	3	4	3	1	16	0	0	19	0	0	19	3	1	0	0	6	10	0	0	0	13	1	14
	III	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	7	8	0	0	0	5	0	5
October	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0
TOTAL		115	108	99	72	51	445	87	9	116	72	8	292	98	102	91	28	144	463	25	93	56	48	44	266

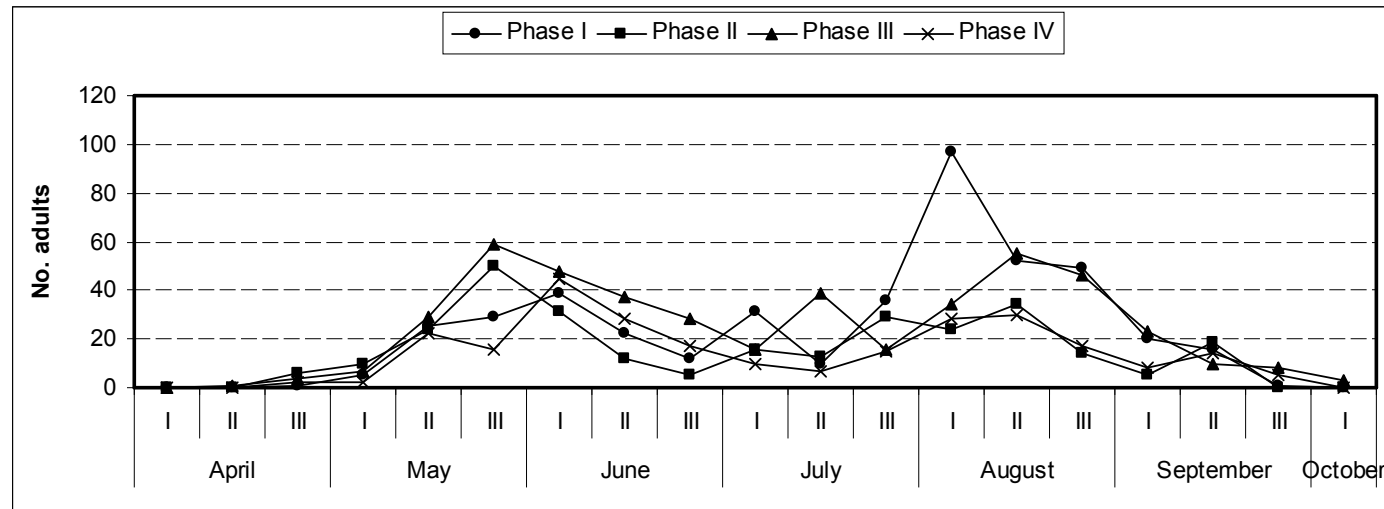


Figure 2. The flight curve made by the adults of *Agrotis segetum* species during 1993 – 2012

Table 3

Amathes C-nigrum

Phase year	Phase I							Phase II					Phase III					Phase IV								
	Month	D	1993	1994	1995	1996	1997	Total I	1998	1999	2000	2001	2002	Total II	2003	2004	2005	2006	2007	Total III	2008	2009	2010	2011	2012	Total IV
April	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	II	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	III	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
May	I	0	0	0	2	0	2	0	0	3	0	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0
	II	0	0	0	17	0	17	2	0	3	0	1	6	1	0	0	0	9	10	0	0	1	0	0	0	1
	III	0	6	2	5	5	18	20	0	6	2	0	28	6	0	0	0	6	12	1	0	1	0	1	0	3
June	I	7	6	15	7	12	47	33	12	3	1	0	49	18	7	0	0	0	25	0	1	5	6	0	0	12
	II	0	2	4	5	21	32	3	14	2	0	0	19	9	9	4	0	0	22	0	4	2	2	0	0	8
	III	3	2	1	1	2	9	3	1	1	0	0	5	2	5	1	0	2	10	0	10	1	1	0	0	12
July	I	1	0	0	2	0	3	6	2	0	0	0	8	0	2	0	0	0	2	1	1	0	0	0	0	2
	II	5	0	2	0	0	7	0	0	0	0	0	0	0	3	3	0	0	6	0	0	2	0	0	0	2
	III	1	1	5	0	1	8	14	0	0	0	0	14	0	4	6	0	0	10	11	6	7	0	2	0	26
August	I	7	9	7	1	10	34	18	0	5	12	0	35	0	0	12	1	7	20	35	2	7	0	3	0	47
	II	20	13	20	5	1	59	27	11	3	12	0	53	0	10	18	113	23	164	25	12	13	4	1	0	55
	III	11	11	13	5	0	40	7	2	7	12	0	28	17	3	55	66	6	147	20	42	3	9	8	0	82
September	I	15	10	7	5	34	71	6	0	10	10	0	26	5	2	1	21	9	38	11	42	1	12	4	0	70
	II	3	0	3	0	1	7	5	0	7	0	0	12	7	2	0	0	3	12	0	9	1	12	2	0	24
	III	0	0	2	0	0	2	0	0	0	0	0	0	0	5	0	0	2	7	0	0	2	3	0	0	5
October	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0
TOTAL		73	60	81	55	87	356	144	42	50	49	4	289	65	52	100	201	70	488	104	129	46	49	21	0	349

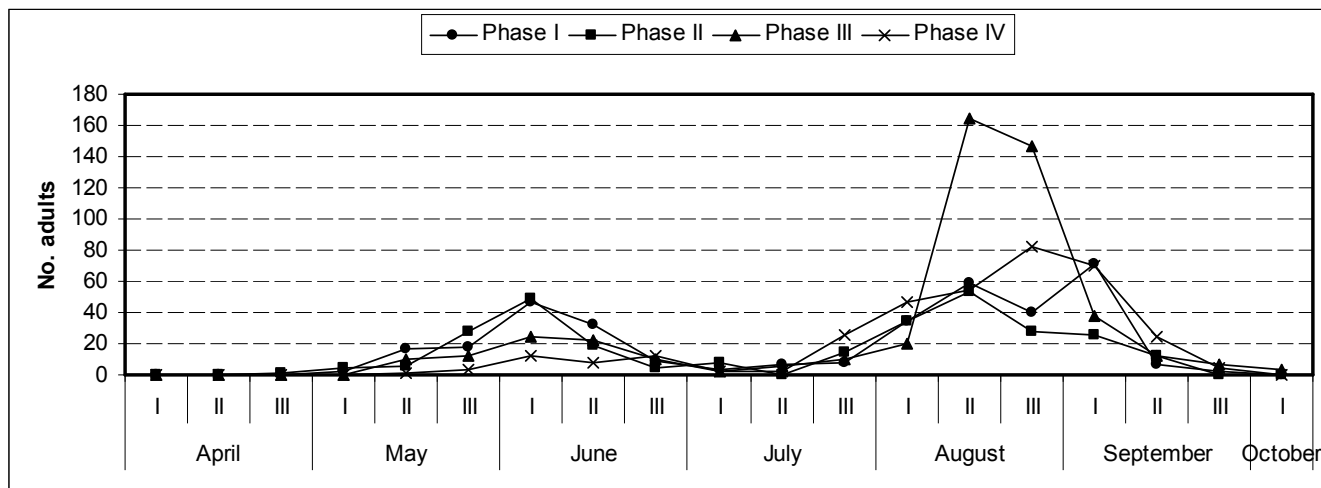


Figure 3. The flight curve made by the adults of *Amathes C-nigrum* species during 1993 – 2012

Table 4

Agrotis exclamationis

Phase year		Phase I						Phase II						Phase III						Phase IV					
Month	D	1993	1994	1995	1996	1997	Total I	1998	1999	2000	2001	2002	Total II	2003	2004	2005	2006	2007	Total III	2008	2009	2010	2011	2012	Total IV
April	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	II	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	III	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May	I	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	II	0	8	1	0	0	9	0	0	6	0	4	10	0	5	0	0	11	16	3	8	0	0	0	11
	III	0	26	3	3	1	33	0	0	17	2	13	32	7	8	6	0	31	52	5	11	0	0	0	16
June	I	32	29	11	13	0	85	3	4	18	11	10	46	49	28	13	0	61	151	4	14	0	0	0	18
	II	0	49	12	17	4	82	4	5	10	5	10	34	29	19	28	0	38	114	2	9	0	0	0	11
	III	7	52	6	6	2	73	2	2	5	0	3	12	4	20	18	0	3	45	1	6	0	0	0	7
July	I	14	10	13	4	3	44	0	0	0	3	0	3	0	11	5	0	0	16	1	4	0	0	0	5
	II	2	2	1	2	0	7	0	0	0	3	0	3	0	6	2	0	0	8	0	5	0	0	0	5
	III	6	4	0	6	0	16	0	0	0	1	0	1	0	4	9	0	0	13	3	9	0	0	0	12
August	I	21	11	1	1	0	34	0	0	11	5	0	16	0	2	10	0	5	17	8	6	0	0	0	14
	II	24	6	6	8	3	47	0	3	10	6	0	19	0	7	0	12	13	32	12	3	0	0	0	15
	III	23	5	11	6	0	45	0	0	6	1	0	7	5	5	0	3	4	17	1	6	0	0	0	7
September	I	0	0	2	0	0	2	0	0	0	0	0	0	1	1	0	0	0	2	0	0	0	0	0	0
	II	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
	III	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
October	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL		129	203	67	66	13	478	9	14	83	37	40	183	96	116	91	15	166	484	40	81	0	0	0	121

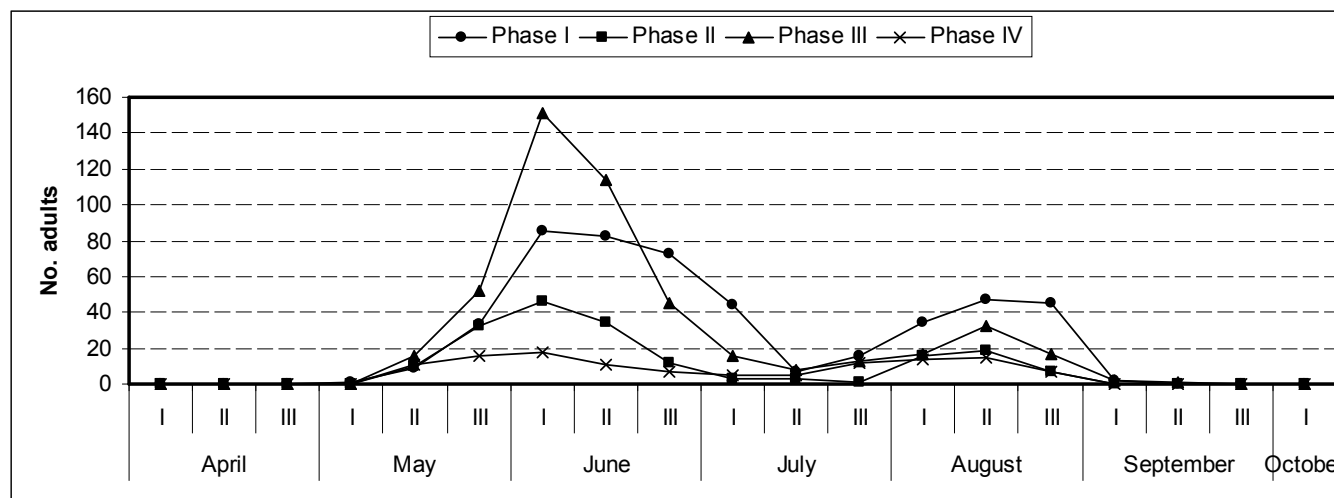


Figure 4. The flight curve made by the adults of *Agrotis exclamationis* species during 1993 – 2012

Table 5

Autographa gamma

Phase year		Phase I						Phase II						Phase III						Phase IV					
Month	D	1993	1994	1995	1996	1997	Total I	1998	1999	2000	2001	2002	Total II	2003	2004	2005	2006	2007	Total III	2008	2009	2010	2011	2012	Total IV
April	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	II	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
	III	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
May	I	0	0	3	0	0	3	1	0	0	3	3	7	0	0	0	0	1	1	0	0	2	0	0	2
	II	0	0	0	14	1	15	0	0	0	0	0	0	0	0	1	0	3	4	2	0	0	3	0	5
	III	0	0	3	0	1	4	1	0	0	1	0	2	0	0	6	0	2	8	0	0	0	1	0	1
June	I	0	0	12	0	0	12	2	0	0	1	3	6	0	0	0	0	4	4	2	0	1	0	0	3
	II	0	3	3	0	1	7	1	14	0	2	1	18	0	1	0	0	4	5	0	0	2	0	0	2
	III	3	2	1	3	1	10	3	3	2	2	0	10	0	3	1	0	0	4	0	0	4	1	3	8
July	I	4	3	18	5	11	41	3	0	2	7	0	12	0	2	3	0	0	5	8	12	3	0	10	33
	II	14	3	8	9	11	45	6	0	1	15	0	22	4	2	13	0	0	19	0	4	1	0	3	8
	III	31	16	10	6	5	68	11	1	4	19	0	35	1	3	8	0	0	12	1	6	9	5	3	24
August	I	58	7	11	1	2	79	6	1	12	18	0	37	0	4	3	0	2	9	0	3	2	1	2	8
	II	19	1	4	1	0	25	0	1	11	6	0	18	0	1	5	0	4	10	7	8	6	4	0	25
	III	19	5	1	5	0	30	0	0	1	13	0	14	0	8	12	18	4	42	6	5	3	1	2	17
September	I	7	11	4	4	8	34	5	0	9	6	0	20	4	5	1	4	0	14	4	5	2	3	8	22
	II	2	6	3	3	1	15	2	0	5	0	0	7	3	9	0	5	0	17	0	1	8	2	6	17
	III	0	1	3	0	0	4	0	0	0	0	0	0	0	9	0	0	0	9	0	0	11	0	1	12
October	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0
TOTAL		157	58	84	51	42	392	43	20	47	93	7	210	12	47	53	27	27	166	30	44	54	21	38	187

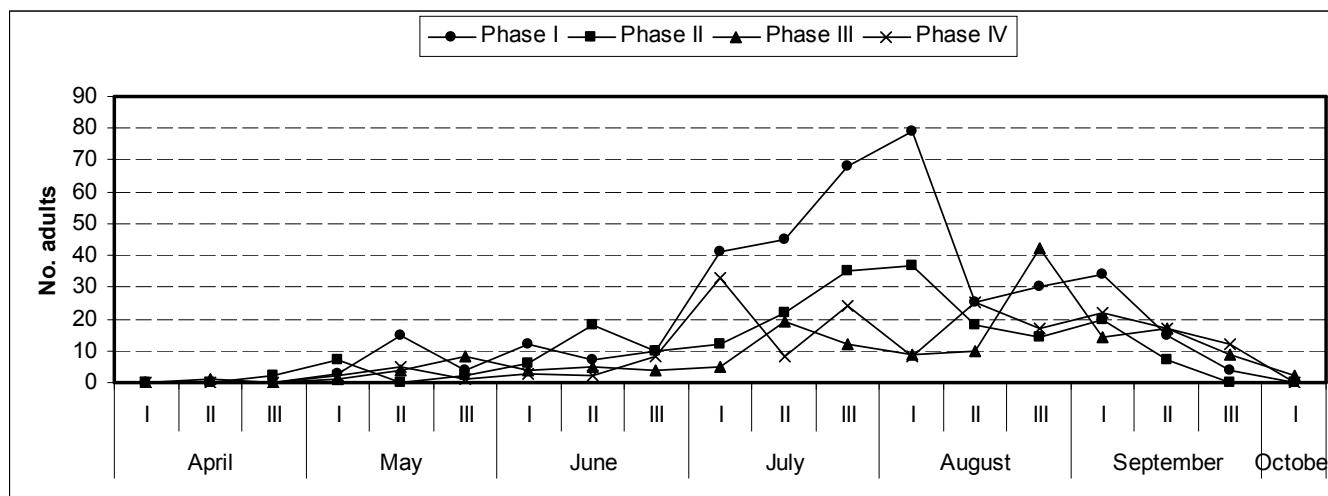


Figure 5. The flight curve made by the adults of *Autographa gamma* species during 1993 – 2012

Table 6

Mamestra oleracea

Phase year		Phase I						Phase II						Phase III						Phase IV					
Month	D	1993	1994	1995	1996	1997	Total I	1998	1999	2000	2001	2002	Total II	2003	2004	2005	2006	2007	Total III	2008	2009	2010	2011	2012	Total V
April	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	II	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	III	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0
May	I	0	0	0	0	0	0	0	0	0	0	14	14	0	3	0	0	4	7	0	0	0	0	0	0
	II	0	0	1	0	0	1	0	0	0	1	7	8	0	4	0	0	13	17	0	4	0	0	0	4
	III	0	0	4	0	0	4	0	0	0	0	4	4	0	6	0	0	6	12	1	6	0	0	0	7
June	I	6	0	0	3	0	9	1	9	0	1	4	15	0	0	4	0	0	4	0	0	2	0	0	2
	II	0	0	1	1	0	2	0	6	0	0	2	8	0	0	3	0	2	5	0	0	0	0	0	0
	III	2	0	1	0	0	3	1	2	0	0	2	5	0	0	0	0	2	2	0	0	1	0	0	1
July	I	0	4	2	1	0	7	0	3	4	0	0	7	2	0	0	0	0	2	0	0	0	0	0	0
	II	0	5	1	3	0	9	0	2	3	0	0	5	3	0	0	0	0	3	0	0	0	0	0	0
	III	0	1	0	2	0	3	0	0	5	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
August	I	6	6	2	0	2	16	0	0	0	11	0	11	0	0	6	0	2	8	0	0	0	0	0	0
	II	1	2	2	0	0	5	0	0	0	3	0	3	0	0	5	0	0	5	0	0	0	0	0	0
	III	5	2	2	0	0	9	0	0	0	10	0	10	0	0	3	0	4	7	0	0	0	0	0	0
September	I	1	0	2	0	1	4	0	0	0	0	0	0	1	0	0	6	0	7	2	0	0	0	0	2
	II	0	2	0	0	0	2	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
	III	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
October	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL		21	22	18	10	3	74	4	22	12	26	34	98	6	13	21	6	34	80	3	10	3	0	0	16

Tabelul 7

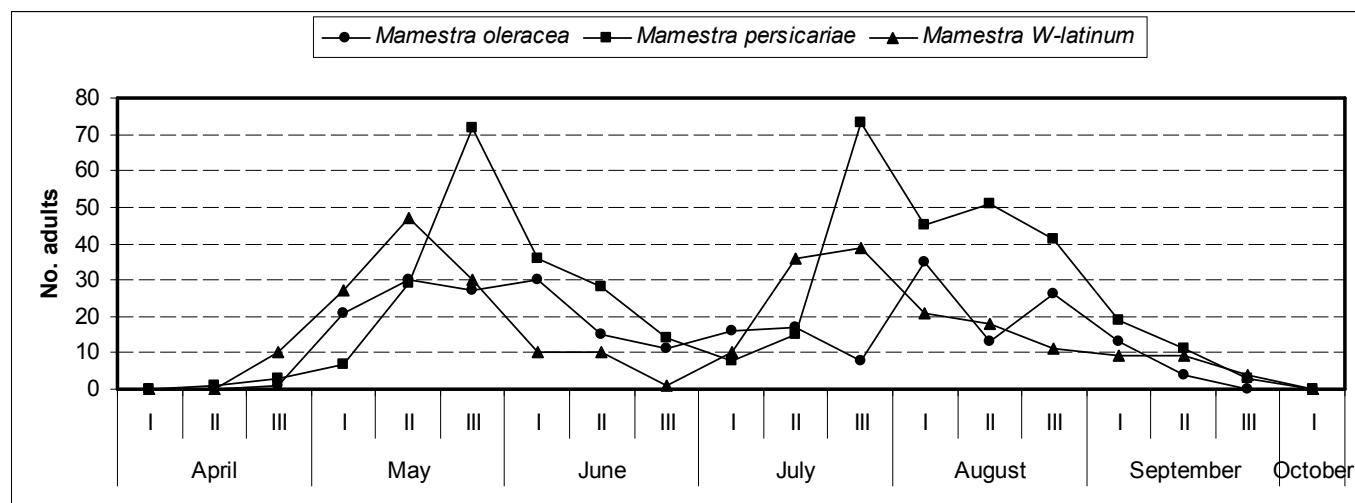
Mamestra persicariae

Phase year		Phase I						Phase II						Phase III						Phase IV					
Month	D	1993	1994	1995	1996	1997	Total I	1998	1999	2000	2001	2002	Total II	2003	2004	2005	2006	2007	Total III	2008	2009	2010	2011	2012	Total IV
April	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	II	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	III	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	1	1	0	0	0	0	0	0
May	I	0	0	0	1	0	1	0	0	0	0	0	0	0	0	4	0	1	5	0	0	0	1	0	1
	II	0	0	0	1	1	2	0	0	6	0	0	6	0	5	1	0	4	10	3	0	6	2	0	11
	III	0	15	1	4	1	21	0	0	17	2	0	19	0	8	8	0	11	27	2	1	2	0	0	5
June	I	0	4	0	5	2	11	4	2	0	1	0	7	5	0	4	0	3	12	2	0	4	0	0	6
	II	0	0	0	1	1	2	1	0	0	0	5	6	1	0	3	0	6	10	1	3	6	0	1	11
	III	0	1	0	0	2	3	1	0	1	0	1	3	2	0	0	0	1	3	1	3	0	1	0	5
July	I	0	0	0	0	2	2	0	1	1	0	0	2	0	0	2	0	0	2	0	2	0	0	0	2
	II	0	0	0	1	0	1	0	0	0	0	0	0	3	0	3	0	0	6	0	7	1	0	0	8
	III	1	1	5	17	4	28	0	2	5	0	0	7	0	2	17	0	0	19	2	11	4	2	0	19
August	I	8	0	1	3	12	24	0	0	6	2	0	8	0	0	2	0	0	2	4	3	4	0	0	11
	II	2	0	1	1	1	5	0	0	4	0	0	4	0	1	4	16	0	21	2	4	15	0	0	21
	III	9	0	2	1	0	12	0	0	1	0	0	1	0	2	7	3	0	12	1	6	6	3	0	16
September	I	0	2	0	0	2	4	0	0	1	5	0	6	0	0	1	7	0	8	0	1	0	0	0	1
	II	0	2	0	0	3	5	1	0	2	0	0	3	0	0	0	0	0	0	0	1	2	0	0	3
	III	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3
October	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL		20	25	10	35	31	121	7	5	44	10	9	75	11	18	56	26	27	138	18	42	53	9	1	123

Table 8

Mamestra W – latinum

Phase year		Phase I						Phase II						Phase III						Phase IV					
Month	D	1993	1994	1995	1996	1997	Total I	1998	1999	2000	2001	2002	Total II	2003	2004	2005	2006	2007	Total III	2008	2009	2010	2011	2012	Total IV
April	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	II	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	III	0	0	0	0	0	0	8	0	0	0	0	8	0	0	0	0	1	1	1	0	0	0	0	1
May	I	0	0	0	0	0	0	15	0	0	1	1	17	2	8	0	0	0	10	0	0	0	0	0	0
	II	0	0	0	8	0	8	8	0	0	1	2	11	10	2	0	0	0	12	2	7	4	3	0	16
	III	0	0	0	0	0	0	8	0	0	1	0	9	1	9	0	0	0	10	3	6	1	1	0	11
June	I	1	0	0	0	0	1	2	3	0	0	0	5	0	0	0	0	0	0	0	0	3	0	1	4
	II	0	3	0	0	0	3	0	1	0	0	0	1	0	0	0	0	0	0	1	0	2	0	3	6
	III	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
July	I	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	5	1	2	0	0	8
	II	0	1	0	0	0	1	4	0	0	1	0	5	14	0	3	0	0	17	4	4	0	0	5	13
	III	0	1	0	0	0	1	5	0	0	4	0	9	1	0	12	0	0	13	4	4	0	0	8	16
August	I	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	3	3	0	0	6	9	18
	II	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	6	0	9	4	0	0	3	2	9
	III	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	2	6	0	0	0	3	2	5
September	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	0	0	0	6	8
	II	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	4	0	0	0	0	5	5
	III	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	1	1
October	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0
TOTAL		1	5	0	8	0	14	50	4	0	8	3	65	30	26	15	9	13	93	29	22	13	16	42	122


 Figure 6. The flight curve made by the adults of *Mamestra oleracea*, *Mamestra persicariae*, *Mamestra W-latinum* species during 1993 – 2012