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FLIGHT DYNAMIC OF ECONOMICALLY IMPORTANT LEPIDOPTERA IN SOMBOR (SERBIA) IN 2009 AND FORECAST FOR 2010

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Abstract

Results of the research on the flight dynamic of the species: *Loxostege sticticalis*, *Ostrinia nubilalis*, *Autographa gamma*, *Helicoverpa armigera*, *Spodoptera exigua*, *Lacanobia oleracea*, *Mamestra brassicae*, *Agrotis ipsilon*, *A. exclamationis*, *A. segetum* and *Hyphantria cunea*, caught by a light trap in Sombor, have been presented. In addition,their quantity is compared with the average for the long term-period from 1980 to 2004 (VAJGAND *et al*., 2008).

A positive forecast for the first generation in 2009 has been made for the species: *O. nubilalis*, *L. oleracea*, *A. exclamationis*, *A. segetum* and *H. cunea*. A negative forecast is made for *M. brassicae*. For the species *L. sticticalis*, *A. gamma*, *H. armigera*, *S. exigua* and *A. ipsilon*, no long term forecast has been made because these are migratory species.

During the year 2009 characteristics of temperature and rainfall had a significant influence on the flight dynamic of some species of moths. The temperature was warmer, precipitation was less. *O. nubilalis* and *A. segetum* had a third generation. *O. nubilalis* and *H. armigera* had a large population, and were an economically important species in Vojvodina. There were few of the hydrophilic species (*Mamestra* brassicae and *L. oleracea*).

KEY WORDS: Lepidoptera, light trap, flight dynamic, *Ostrinia nubilalis*.

Introduction

It is important to follow quantities and flight dynamics for warning of possible damage. The forecast is based on the Integral Pest Management in plant protection. Research on moths in the region of Sombor started in 1979 (RADIN & TOŠEV, 1983).

More than 18,000 specimens of moths have been determined in the laboratory of "Agroprotekt" in 2009. More than 140 species of moths have been determined. For each of the species the flight dynamic was registered. We have given data about the flight of: *Loxostege sticticalis, Ostrinia nubilalis, Autographa gamma, Helicoverpa armigera, Spodoptera exigua, Lacanobia oleracea, Mamestra brassicae, Agrotis ipsilon, A. exclamationis, A. segetum* and *Hyphantria cunea.* Thus it was possible to make a forecast for the species for 2010.

To explain results of the flight dynamic, we have compared the values of temperature and precipitation in 2009 with the average values for Sombor for the period from 1948 to 2008.

Material and Methods

With a 250W mercury light as the light source, "Agroprotekt" used the light trap type RO Agrobečej for catching moths. The light trap was placed in the southern suburb of Sombor; according to the UTM net, the place was marked CR45. The trap was operational from April 10th to October 10th when moths were collected and determined daily in the laboratory of "Agroprotekt".

Average meteorological data are presented for the period from 1948 to 2008. We are grateful to the the Faculty of Agriculture in Novi Sad for the meteorological data they provided. The temperature curve shows that April was warmer than average by 3 ºC, May by 1.8 ºC, July by 1.7 ºC, August by 2.1 ºC and September by 2.4 ºC. Only June was colder than average by 0.4 ºC (Fig. 1).

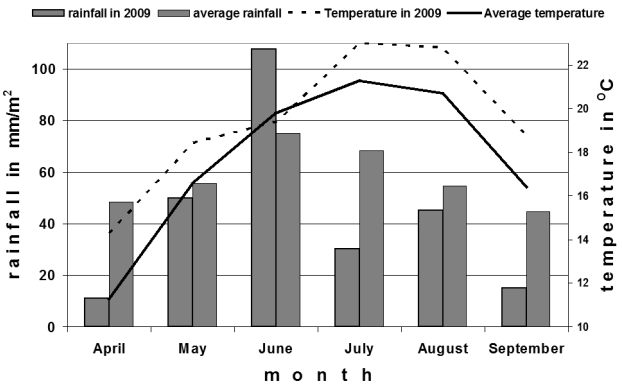

Figure 1. Meteorological data for Sombor in 2009 and average data for period from 1948 to 2008.

The average temperature in the vegetation period in 2009 was warmer by 1.8 ºC, or 10%, compared with the long term period. The total sum of temperature was 323,6 ºC higher than in the average vegetation period. Thus moths had 15 days more of accumulated warmth energy for development. The total precipitation for the period from April to September was 87,8 mm/m^2 less than the average! Only June had 32 mm precipitation more than the average, but this precipitation could not compensate for the deficit of water in the soil from April and May. Hence the year 2009 was very warm and dry compared with the long term period.

Results and Discussion

Results of the counting of moths collected using the light trap over a 10-day period are presented in the Tab. I. The results from Sombor for 2009 have been compared with earlier data for Sombor (VAJGAND *et al*., 2008) (Tab. II).

Loxostege sticticalis (Linnaeus, 1761) – Beet webworm

In Sombor the average number of moths per year is 215 specimens (Vajgand *et al*. 2008). In 2009 this species was not registered in Sombor. This is the first year without a catch, and the smallest number since 1980. We did not make a long-term forecast because this is a migratory species.

Ostrinia nubilalis (Hübner, 1796) – European corn borer

The first specimen was caught on April 29th. Permanent flight started on May 6th. Until May 17th numbers were low but from that date, the daily numbers increased quickly and peaked first on May 26th: 53 females were registered per night. After this the numbers declined for a few days, and increased later (Fig. 2). The second peak of the first generation and the flight maximum was on June 6th, when 75 females were registered per night. The end of flight of the first generation was on July 10th. In 2009, 1649 specimens of the first generation were registered (Tab. II), which is 1.8 times more moths than the average for Sombor (VAJGAND *et al*., 2008).

The second generation started to fly on July 11th. The number of moths increased fast from the 23rd; the peak and the maximum flight of the second generation occurred on August 4th: 438 females per night. The second peak was on August 21st, when 121 females were registered per night. The second generation finished flight on September 4th. 4688 specimens of the second generation were registered in Sombor, which is half of the average for the the long term period for Sombor.

A small third generation was registered from September 5th to 28th: 115 specimens were caught. The maximum flight of the third generation was on September 18th. Nine females were registered per night.

The percentage of the first generation in Sombor in 2009 was 25.5%, the second 72.5% and the third 2%. August and September of 2009 were dry, but numbers were high, so a large population in the first generation in 2010 is expected.

Autographa gamma (Linnaeus, 1758) – Silver Y moth

Only 90 specimens were caught in Sombor, which is only 16% of the average number (Tab. II). Moths were caught from May 8th to October 10th with a few short breaks. The largest number was caught on June 1st and August 16th: four specimens per night. In 2009 we have registered no migration in our region. As well, because this is a migratory species no long term forecast was made.

Helicoverpa armigera (Hübner, 1808) – Cotton Bollworm, Corn Earworm

The first four single moths in Sombor were registered from May 13th to 17th (Fig. 3). The second period of flight started on June 8th. Until August 3rd (with a short pause) a few moths were caught per night. From August 8th numbers increased until August 20th, when the maximum of flight was registered (46 moths per night). After this, the number was reduced until September 5th. Then again it increased until September 20th,

when a peak was registered (12 moths per night). Single moths were registered till October 10th. The total number of moths in Sombor in 2009 was 493. This is only 31% of the average for Sombor (Tab. II), but is much more than the economical level. This is a migratory species, and no forecast has been made.

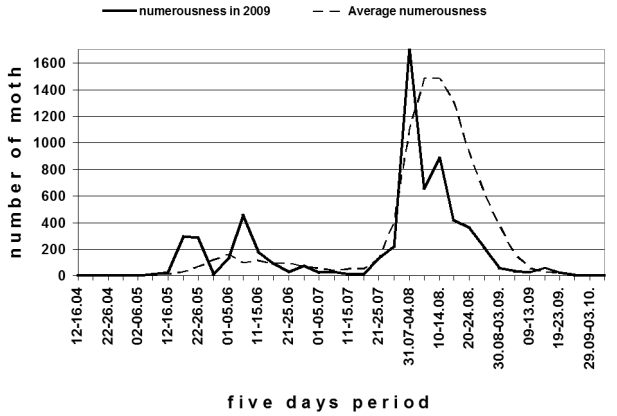

Figure 2. Flight dynamics of *Ostrinia nubilalis* on light trap in Sombor.

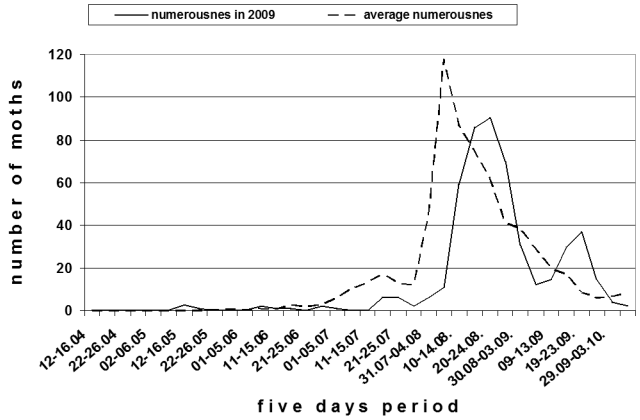

Figure 3. Flight dynamics of *Helicoverpa armigera* on light trap in Sombor.

Spodoptera exigua (Hübner, 1808) - Beet armyworm

17 moths were registered in 2009 in Sombor. 12 single moths were caught in the period from July 15th to August 27th and five from September 18th to October 2nd. This is 49% of the average number in Somber (Tabs. I and II) which was unexpected because this species likes warm weather. This is a migratory species and no forecast has been made.

Lacanobia oleracea (Linnaeus, 1758) – Bright-line Brown-eye

The moth flying period started on April 11th, 15 days before the usual time (Fig. 4). The first generation of moths flew until June 27th. The maximum number was registered on May 20th: 21 specimens per night. 170 specimens were caught during the first generation flight period which is 84% of the average number for the first generation. The second generation flew from July 12th to September 17th. A single specimen was registered without peak or flight maximum. Only 59 specimens of the second generation were registered which is only 29% of the average number. The total sum for 2009 in Sombor is 229 specimens, 56% of the average.

L. oleracea in 2009 was important for cabbage and cauliflower. The first generation needs to be sprayed with insecticide several times, and the second generation only once or twice.

For 2010 we predict average numbers for the first generation. Damage to cabbage but not to sugar beet can be expected for the first generation.

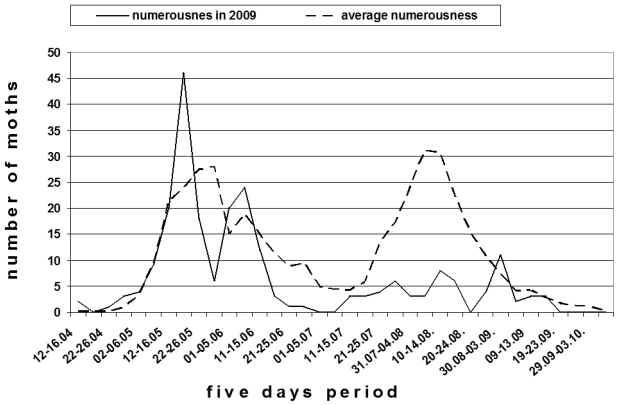

Figure 4. Flight dynamics of *Lacanobia oleracea* and light trap in Sombor.

Mamestra brassicae (Linnaeus, 1758) – Cabbage moth

Only three specimens of the first generation were registered on May 6th, 18th and 23rd. The second generation was present from July 5th to 23rd (eight single specimens), and two single specimens on August 26th and September 8th. We registered 13 specimens in all of 2009 in Sombor (Tab. II). This is only 11% of the average number for Sombor.

For the first generation in 2010 we make a negative forecast. We expect damage to local cabbage where it is grown in a big area.

Agrotis ipsilon (Hufnagel, 1766) – Black cutworm, Dark sword – grass moth

Only a single specimen was registered: four from April 19th to May 3rd, eight from June 10th to July 11th, and one on August 31st, and October 3rd and 10th (Tab. I). The total is 15 (Tab. II), which is 28% of the average number per year for Sombor. We have not made a forecast for 2010 because this is a migratory species.

Agrotis exclamationis (Linnaeus, 1758) – Heart & dart

The first generation flew from May 18th to June 11th with a big break between catches. Eleven specimens were registered. Maximum flight was on May 20th, with five moths per night. Eleven specimens were registered which is 13% of the average quantity for Sombor. The second generation flew from June 20th to August 29th. No maximum flight was registered. The biggest number of moths was present from July 23rd to 25th (Fig. 5). The number of registered specimens was 52 (Tab. II) which is only 44% of the average number for Sombor.

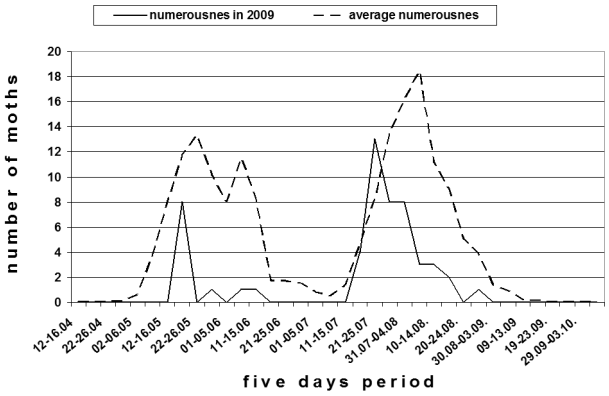

Figure 5. Flight dynamics of *Agrotis exclamationis* in light trap in Sombor.

We have made a positive forecast for the first generation in 2010: the number of moths was too small for damage to be expected from the first generation of this species.

Agrotis segetum (Denis & Schiffermüller, 1775) – Turnip moth

In 2009 the moth was present in three generations (Fig. 6). First it was present from May 1st to June 9th. The maximum flight was on May 20th, with five specimen per night. The sum of first generation moths was 21 which is 22% of the average quantity for Sombor. The second generation was present from July 06th to August 13th. The maximum flight was on August 4th. Two peaks of flying were also registered, on July 25th, and August 10th (five specimens). There were 49 specimens of the second generation. Single specimens were registered on August 26th and September 3rd. The third generation was present from September 7th to October 9th. Maximum flight was on September 19th when seven specimens were registered. The total of specimens in the third generation was 52.

The total sum of moths is 124. This is 38% of the average number for Sombor.

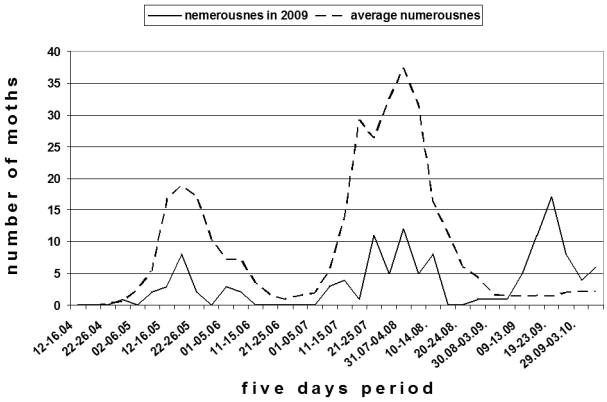

Figure 6. Flight dynamics of *Agrotis segetum* and the light trap in Sombor.

Table I. Quantity of moths in a light trap in Sombor during a ten-day period 2009.

Period	Species										
	L. sticticalis	*O. nubilalis*	*A. gamma*	*H. armigera*	*S. exigua*	*L. oleracea*	*M. brassicae*	*A. ipsilon*	*A. exclamationis*	*A. segetum*	*H. cunea*
12-21.04	0	0	0	0	0	2	0	2	0	0	0
22.04-01.05	0	1	0	0	0	4	0	1	0	1	0
02-11.05	0	11	2	0	0	13	1	1	0	3	0
12-21.05	0	318	3	4	0	66	1	0	8	11	1
22-31.05	0	296	1	0	0	24	1	0	1	2	0
01-10.06	0	593	13	2	0	44	0	1	1	5	0
11-20.06	0	272	6	2	0	15	0	1	1	0	0
21-30.06	0	103	5	2	0	2	0	2	0	0	0
01-10.07	0	55	5	1	0	0	2	3	0	3	0
11-20.07	0	23	5	6	2	6	4	1	4	5	0
21-30.07	0	349	6	8	2	10	2	0	21	16	0
31.07-09.08	0	2361	6	17	3	6	0	0	11	17	2
10-19.08	0	1296	13	145	1	14	0	0	5	8	0
20-29.08	0	576	4	160	4	4	1	0	1	1	0
30.08-08.09	0	90	3	43	0	13	1	1	0	2	0
09-18.09	0	80	11	45	1	6	0	0	0	16	0
19-28.09	0	28	4	52	2	0	0	0	0	25	0
29.09-10.10	0	0	3	6	2	0	0	2	0	10	0

The dynamics of flight were different compared with the average dynamics (Fig. 6). There were three clear separate periods. The first time the third generation was bigger than the second.

The forecast is positive for the first generation in 2010. But because the numbers were so small we think that the first generation of *A. segetum* cannot be economically important in Vojvodina except in places where damage was done in the last few years.

Hyphantria cunea (Drury, 1773) – Fall webworm

In the locality of Sombor, only three single specimens per night were registered on May 18th, and August 6th and 9th which is the smallest number per year since 1980. (VAJGAND, 1999, 2008; VAJGAND *et al*., 2008). Compared with previous times, this number is much lower than the average per year for Sombor, which is 396 moths (VAJGAND *et al*., 2008).

According to the quantities in 2009, we expect small numbers for the first generation in 2010; locally, this species can be economically important in 2010 on ornamentals, walnut (*Juglans regia*) and mulberry trees (*Cornus mas*).

Table II. Number of moths in 2009 in Sombor and comparison with the average for a long term period (VAJGAND *et al*., 2008).

	Number of moths of first generation		Number of moths of second or second and third generation		Total sum per year		2009x100/ average
Species	**average**	**2009**	**average**	**2009**	**average**	**2009**	**(%)**
Loxostege sticticalis[1]	0	0	0	0	215	0	0
Ostrinia nubilalis[1]	940	1649	8222	4803	9163	6452	70
Autographa gamma[1]	0	0	0	0	549	90	16
Helicoverpa armigera[2]	0	0	0	0	1565	493	32
Spodoptera exigua[2]	0	0	0	0	35	17	49
Lacanobia oleracea[1]	202	170	205	59	408	229	56
Mamestra brassicae[1]	13	0	108	10	121	13	11
Agrotis ipsilon[1]	0	0	0	0	39	15	38
Agrotis exclamationis[1]	83	11	95	42	178	53	30
Agrotis segetum[1]	96	21	232	103	330	124	38
Hyphantria cunea[1]	131	1	265	2	396	3	1

1 Average for period 1980-2004
2 Average for period 1994-2004

Conclusion

All species were less numerous during 2009 than in the long term period (Tab. II). We believe that the main cause of this decline is a very warm and dry vegetation period (Fig. 1).

In 2009 the species *L. sticticalis, A. gamma, M. brassicae* and *H. cunea* had less than 16% of the average. Economically important species during 2009 in the same regions were: *O. nubilalis, H. armigera, L. oleracea* and *M. brassicae*. Warm weather caused the emergence of the third generation of species *O. nubilalis* and *A. segetum,* like in 2008 (VAJGAND, 2009).

A positive forecast for the first generation in 2010 has been made and presented for the species: *O. nubilalis, L. oleracea, A. exclamationis, A. segetum* and *H. cunea*. Because the species *A. exclamationis, A. segetum* and *H. cunea* had small numbers, they can be economically important in 2010 only locally. A negative forecast was made for *M. brassicae*. For the species *L. sticticalis, A. gamma, H. armigera, S. exigua* and *A. ipsilon*, a long term forecast was not made because these are migratory species.

Every year flight dynamics have some special characteristics, and the control of the number of these species must be continued.

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ДИНАМИКА ЛЕТА ЕКОНОМСКИ ЗНАЧАЈНИХ ВРСТА LEPIDOPTERA У СОМБОРУ ТОКОМ 2009. И ПРОГНОЗА ЗА 2010. ГОДИНУ

ДРАГАН ВАЈГАНД

Извод

У раду су дати резултати праћења динамике лета врста: *Loxostege sticticalis, Ostrinia nubilalis, Autographa gamma, Helicoverpa armigera, Spodoptera exigua, Lacanobia oleracea, Mamestra brassicae, Agrotis ipsilon, A. exclamationis, A. segetum* и *Hyphantria cunea* (Табела 1). За праћење је коришћена светлосна клопка типа РО Агробечеј. Резултати су упоређени са вишегодишњим подацима за период од 1980. до 2004. године (VAJGAND *et al*., 2008) (Табела 2).

Ако упоредимо метеоролошке податке за Сомбор из 2009. године са вишегодињим просечним подацима, може се констатовати да је током вегетационог периода 2009. година била много топлија (за 1,8 ºC више) и много сувља (87,8мм по метру квадратном падавина мање).

Бројност врста *L. sticticalis, A. gamma, M. brassicae* и *H. cunea* је током 2009 године је чинила мање од 16% просечне бројности (Табела 2).

Позитивна прогноза за прву генерацију током 2010. године се даје за врсте: *O. nubilalis, L. oleracea, A exclamationis, A. segetum* и *H. cunea*. Негативна прогноза се саопштава за врсту *M. brassicae*. За врсте *L. sticticalis, A. gamma, H. armigera, S. exigua* и *A. ipsilon*, дугорочна прогноза се не саопштава јер су миграторне врсте.

Врсте *O. nubilalis* и *A. segetum* су имале трећу генерацију (Графикони 2 и 6).

O. nubilalis, H. armigera, M. brassicae и *L. oleracea* су током 2009 су биле економски значајне врсте.

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