

OBSERVATIONS ON THE BIOLOGY OF THE CAMERARIA OHRIDELLA DESCHKA DIMIČ SPECIES (LEAF MINING MOTH), DANGEROUS PEST OF THE CHESTNUT TREE

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ABSTRACT

The knowledge of biology of the Cameraria ohridella Deschka & Dimič species are of special importance for determining the moments and the control measures to be applied against it to prevent the attack on the chestnut trees crown.

In this paper, we bring the new contributions to the knowledge of the biology of chestnut leaf mining moth. These observations consisted in systematic registration of data on the occurrence and flying insect, oviposition, the completing larval stage, the pupa stage of development and, re-start the cycle to each generation, observations were conducted using pheromone traps "atra-CAM", type - end reading their every 3 days.

INTRODUCTION

Cameraria ohridella Deschka & Dimič has as main host ornamental chestnut, Aesculus hippocastanum L., ornamental species common in Europe, the preferred alignments for which it gives rich shade.

For the first time in Macedonia it was reported in 1985, around Lake Ohrid, close to the border with Albania and was described as a species new to science a year later. The true origin of the species is not known yet. (Augustine, S, 2009)

Cameraria genre is not represented by other species in Europe but some species belonging to the genus are found in Asia and North America. This supports the hypothesis of introducing species in Albania by the Chinese travel and after the flight has begun spreading through adult species habitat expansion taking place, first in countries of the former Yugoslavia, in the late 1980s (Badescu A. , 2003 si Brudea, V., 2010)

It was reported in 1989 in Zagreb, the Croatian capital. In the same year it was reported in Bulgaria. Also in 1989, was introduced deliberately in Austria at Linz by an entomologist, the purpose of a study without taking into account the consequences of a leak under control specimens studied. After losing control of insects, this location in Austria was the point of extending to many European countries.

Between 1993 - 1998 it was extended to Slovakia, Slovenia, Germany, Hungary, Switzerland and Poland, and between 2002 - 2004 was reported in the UK, Spain, Russia and Denmark and Lithuania. (Gansca L. 2009, Oltean I. 2009)

In Romania the presence of the insect was first reported in the west of the country, in Timisoara, in 1996, in 1998 was observed in central regions, Cluj-Napoca.

In 2005 the insect was observed in Vasluicounty, and in 2006 began to issue warning bulletins for combating insect.

MATERIAL AND METHOD

Research undertaken over the five years had the objective of studying the biological cycle, flight dynamics adults and influence of climatic factors on the species Cameraria ohridella Deschka Dimič, the issuing bulletins warning by proposing chemical treatments

that measures to limit the population in conditions zone climate Huși Vaslui County (Milici Ionica 2007 and Șandru I. 2002).

RESULTS AND DISCUSSIONS

For adults flight tracking of *Cameraria ohridella* were used pheromone traps, AtracAM. Thus was used by a trap / location, and change baits were made monthly from May to September in the years 2012, 2013, 2014, 2015 and 2016. notary on flight dynamics adults were done 3 times a week.

In order to correlate weather data obtained with the amounts were calculated degrees of the actual temperature (above 12C) for each stage of development.

Between 2014 - 2015, following the observations in nature, that the insect has three generations per year, iernând the pupa in a cocoon made from the leaf epidermis, the galleria of food for the larva.

Insect population level is influenced by weather conditions every year, especially in 2015, when losses inseminated, but have evolved almost normal stages.

Flight Dynamics adults of *Cameraria ohridella* Deschka Dimič in Husi, in 2014

In 2014, the first generation of adults caught - he III (hiemală) occurred on 10.05, a $\Sigma(t_n - t_o) = 85,25C$ (tab. 1).

Table 1

Flight Dynamics adults of *Cameraria ohridella* Deschka Dimič in Husi, in 2015

G3		G1		G2	
Adult appearance	Adults captured	Adult appearance	Adults captured	Adult appearance	Adults captured
10.05	30	29.06	157	11.08	100
12.05	50	01.08	166	13.08	320
15.05	122	03.07	186	15.08	300
18.05	180	06.07	381	18.08	310
21.05	315	09.07	400	21.08	192
23.05	388	12.07	378	23.08	173
25.05	310	15.07	290	25.08	125
28.05	260	18.07	220	28.08	100
31.05	350	21.07	200	31.08	95
03.06	110	23.07	190	03.09	71
06.06	100	25.07	160	06.09	13
09.06	81	28.07	75	09.09	12
12.06	18	31.07	50		
15.06	17	03.08	55		
18.06	15	06.08	33		
21.06	-	09.08	24		
25.06	-				
27.06	-				
$\Sigma(t_n - t_o)$	Duration of flight	$\Sigma(t_n - t_o)$	Duration of flight	$\Sigma(t_n - t_o)$	Duration of flight
52,95 ⁰ C	41	362,36 ⁰ C	-	783,42 ⁰ C	27

The flight was augmented adults between May 21 to June 6 for 20 days (Figure 1).

Flight of butterflies in May was influenced by heavy rains fallen for 16 days, when they recorded 179 mm rainfall. The greatest amount of precipitation was recorded on 15 May when they fell 52 mm rainfall. After 10 June, the flight for adults began to decline, so that for three days, 22-25 June, have not caught butterflies. The adult generation III flight-a (G3) lasted 39 days (10.05 - 18.06).

Adults Generation I (G1) occurred on 29.06, a $\Sigma (t_n - t_o) = 378,770C$. Numerous flight took place between 03.- 25.07 for 22 days and a maximum between 16 and 15 July. 25.07 after the flight began to fall, but not stopped, so that it overlaps the second generation.

Adults II generation began to appear 11.08, a $\Sigma (t_n - t_o) = 833,96C$, numerous flights took place between 13 - 28.08, for 15 days and the maximum flight curve was recorded during 13 - august 18th. Adults have flown until September 9.

The mining moth life cycle of the *Cameraria ohridella* in Husi in 2014

Life cycle of the moth mining chestnut in the Huși Vaslui, was seen parks and alignments, monitoring the emergence of adult oviposition, emergence of larvae and stern, during each stage of the insect and the sum of effective temperatures for all generations of the insect.

Adults generation III (hiemală) occurred on 10.05, a $\Sigma (t_n - t_o) = 85,25C$ (table 2).

The flight of butterflies and oviposition in May was hampered by heavy rains fallen for 16 days, when they recorded 179 mm rainfall, the deviation from the average is 118.9 mm and average daily temperatures relatively small until 18.05 between 9.6 and 16.2C.

After mating and sexual maturation, females began oviposition on 20.05, a $\Sigma (t_n - t_o) = 100,250C$ and hatched after about 8 days at a temperature of 20.00C decade average. Ponta is filed throughout the insect's flight, the last eggs were observed on 21.06.

V1 larvae first appeared on May 28, at a $\Sigma (t_n - t_o) = 147,49C$, and stage lasted 24 days at a temperature of about 20C decade average.

Pupa was observed in 21/06 at a $\Sigma (t_n - t_o) = 324,88C$, and after 8 days at an average temperature of 18.3 0 C butterflies have occurred first generation -Get on 29.06, a $\Sigma (t_n - t_o) = 378,77C$.

First generation lasted 40 days (the deposit first eggs until the appearance of the first butterflies).

After the sexual maturation and mating butterflies I submitted the first generation eggs on leaves of 05.07, a $\Sigma (t_n - t_o) = 427,78C$. Incubation lasted about 5 days, the first hatched larvae appeared to 10.07 only in one $\Sigma (t_n - t_o) = 484,01C$. Larval stage duration was 22 days at the decadal average from 21.6 to 22.5 0 C and a relative humidity of 74%.

As of 03.08. first kiss was recorded at a $\Sigma (t_n - t_o) = 736,7C$ in 20%, and the pupae 05.08 percentage was 55% at $\Sigma (t_n - t_o) = 723,09C$.

Pupal stage duration was 8 days at an average temperature of 24.2 0C decadal so on 11.08, a $\Sigma (t_n - t_o) = 833,96C$, butterflies began to appear first generation -II has .

Butterflies II generation he started oviposition on 17.08, a $\Sigma (t_n - t_o) = 906,95C$. Deposition in the egg mass was 20.08 registered in a ratio of more than 50%. Incubation lasted 5 days, while the first 22.08 larvae appeared V1 at a $\Sigma (t_n - t_o) = 949,95C$. Larval stage duration was approximately 25 days at a temperature of 19.6 C decade average.

15. The first kiss occurred 09 to a $\Sigma (t_n - t_o) = 1143,25C$. Transforming the percentage of over 50% took place on 20.09, a $\Sigma (t_n - t_o) = 1160,19C$.

The environmental conditions in the area Husi - Vaslui, in 2014, the species *Cameraria ohridella* Deschka Dimic has 3 generations complete, namely: Generation I was (G1) evolved in the period May 20 to June 29 for 40 days; Generation II (G1) which evolved during July 5 to August 11 for 37 days and the second generation (G1) has evolved in the months August 17 to May 8.

Table 2

**Appearance of the first stages of mining moth
Cameraria ohridella Deschka Dimič, 2014**

Generation	Stage	Adult appearance	The duration of stages	$\Sigma(t_n - t_o)$
G3 (hiemal)	Adults	10.05	39	85,25 ⁰ C
G1 40 days	egg	20.05	6	100,25 ⁰ C
	larvae	28. 05	30	147,49 ⁰ C
	pupae	19.06	10	315,81 ⁰ C
	adult	29.06	-	378,77 ⁰ C
G2 37 days	egg	05.07	5	427,78 ⁰ C
	larvae	10.07	22	484,01 ⁰ C
	pupae	03.08	8	736,70 ⁰ C
	adult	11.08	28	833,96 ⁰ C
G3 up to May 2015	egg	17.08	5	906,95 ⁰ C
	larvae	22.08	20	949,95 ⁰ C
	pupae	15. 09	212	1143,25 ⁰ C

Table 3

Mining moth life cycle of chestnut *Cameraria ohridella* Deschka Dimič, 2014

Year	Generation		
	I	II	III
2014	20 may – 29 june	05 july – 11 august	17 august – 08 may

Flight Dynamics adults of *Cameraria ohridella* Deschka Dimič in Husi, in 2015

In 2015 the first generation adults III (hiemal) occurred on 08.05, a $\Sigma (t_n - t_o) = 70,12C$. Flight numerous adults began on 12 May to 03 June for 23 days and had a maximum flight curve during May 21 to 28 for 7 days (Table 4)

Flight III -a adult generation (G3) lasted 42 days (08.05 - 18.06).

The adults generation I (G1) occurred on 21.06, a $\Sigma (t_n - t_o) = 416,93C$. Flight numerous analyzes were registered during June 25 to July 18 for 24 days and the maximum flight was recorded during 28.06.- 09.07 for 12 days.

Table 4

Flight Dynamics adults of *Cameraria ohridella* Deschka Dimič in Husi, in 2015

G3		G1		G2	
Adult appearance	Adults captured	Adult appearance	Adults captured	Adult appearance	Adults captured
08.05	92	21.06	73	01.08	100
12.05	145	23.06	89	03.08	100
16.05	199	25.06	166	06.08	185
18.05	210	28.06	381	09.08	217
21.05	315	30.06	410	12.08	321
23.05	388	03.07	368	15.08	400
25.05	389	06.07	300	18.08	310
28.05	310	09.07	290	21.08	192
31.05	260	12.07	220	23.08	163
03.06	250	15.07	168	25.08	94
06.06	110	18.07	140	28.08	70
09.06	93	21.07	100	31.08	15
12.06	81	23.07	85	03.09	18
15.06	20	25.07	41		
18.06	17	26.07	37		
		31.07	21		
$\Sigma(t_n - t_o)$	Duration of flight	$\Sigma(t_n - t_o)$	Duration of flight	$\Sigma(t_n - t_o)$	Duration of flight
70,12 ⁰ C	41	416,93 ⁰ C	-	892,85 ⁰ C	34

After 18.07 the flight began to fall, but not stopped, so that it overlaps the second generation. Duration of flight generation I can not say precisely.

Adults II generation emerged 01.08, a $\Sigma (t_n - t_o) = 892,85C$, augmented their flight was recorded between August 6 to August 23 for 18 days and the maximum flight curve was recorded from 12 - 18.08 for 6 days. Butterflies have flown continue until 3rd September.

The mining moth life cycle of the *Cameraria ohridella* in Husi, in 2015

Environmental conditions in the Husi area, 2015 Chestnut mining moth *Cameraria ohridella* Deschka Dimič a winter as pupa in the fallen leaves on the ground.

Adults generation III (hiemală) occurred on 08.05, a $\Sigma (t_n - t_o) = 70,120C$ (tab. 5).

After copulation and sexual maturation, 7 days from the first appearance of butterflies, females began oviposition.

The first eggs were deposited on 15.05, a $\Sigma (t_n - t_o) = 101,86C$. Pupa is filed throughout the insect's flight, the last eggs were observed on 19.06.

Incubation lasted about 7 days, and the larvae first appeared at 22.05 V1 at a $\Sigma (t_n - t_o) = 139,73C$. Incubation was hurt by the fact that many of the eggs have hatched there (6-7%), atmospheric and soil drought because of decade II yet installed aa April and continued into May, the amount of rainfall in the first decade was 7.4 mm (3-4 May).

Larval stage lasted 22 days at a temperature of about 21,8C decade average, but low humidity of 55%.

Pupa was observed on 13.06, a $\Sigma (t_n - t_o) = 348,18C$, and after eight days appeared first generation butterflies -I was on 21.06, a $\Sigma (t_n - t_o) = 416,93C$.

Generation I lasted 40 days (the deposit first eggs until the appearance of the first butterflies).

After copulation, the first eggs (me) new leaves were observed on 27.06, a $\Sigma (t_n - t_o) = 469,76C$.

Incubation at a temperature of 240C decade average it took about 3 days, the first emerged larvae on 03.07, a $\Sigma (t_n - t_o) = 520,080C$. The duration of the larval stage was 20 - 21 days at a decadal mean temperature of about 24 - 260C.

On 24.07. first pupae were recorded on a $\Sigma (t_n - t_o) = 787,65C$, in a proportion of 10%, and the percentage of pupae 29.07 was 50% at a $\Sigma (t_n - t_o) = 860,60C$.

Pupal stagewas with duration of 8 days, so on 01.08, a $\Sigma (t_n - t_o) = 892,85C$ butterflies began to appear first generation has -II (butterflies appear as clove leaf, but stay a few hours before flying so).

Second generation lasted 38 days (the deposit first eggs until the appearance of the first butterflies).

After about 8 days after onset of the first generation of butterflies II - began oviposition on 09.08, a $\Sigma (t_n - t_o) = 1002,7C$. The massive egg deposition was recorded 15.08 in 60%.

After about 5 days after oviposition larvae were first on 13.08, a $\Sigma (t_n - t_o) = 1065,35C$. Larval stage The duration of was approximately 22 days.

The first appearance occurred 09.04 to a $\Sigma (t_n - t_o) = 1308,56C$, the rate of 7-8%, and on 10.09, a $\Sigma (t_n - t_o) = 1085,94C$ percentage was 48% from pupae analyzed. At this stage the insect hibernating up to May next year.

The environmental conditions from the Husi - Vaslui area, in 2015, the species *Cameraria ohridella* Deschka Dimič has a 3 generations: Generation I was (G1) evolved in the period May 15 to June 21 for 40 days; second generation (G2) which evolved during 27 June to 1 August for 35 days and Generation III (G3) which evolved during the months of August 9 to May 9 on the ground.

Table 5

**Appearance of the first stages of mining moth
Cameraria ohridella Deschka Dimic, 2015**

Generation	Stage	Adult appearance	The duration of stages	$\Sigma(t_n - t_0)$
G3 (hiemal)	Adults	08.05	42	70,12⁰C
G140 of day	egg	15.05	7	101,86⁰C
	larvae	22.05	22	139,73⁰C
	pupae	13.06	8	348,18⁰C
	adult	21.06	-	416,93⁰C
G235of day	egg	27.06	5	469,76⁰C
	larvae	03.07	21	520,08⁰C
	pupae	24.07.	8	787,65⁰C
	adult	01.08	34	892,85⁰C
G3up to 09 May 2016	egg	09.08	5	1002,7⁰C
	larvae	13.08	23	1065,35⁰C
	pupae	04.09	213	1308,56⁰C

Table 6

Mining moth life cycle of chestnut *Cameraria ohridella* Deschka Dimic, 2014

Year	Generation		
	I	II	III
2015	15 may – 21 june	27 june - 01 august	09 august – 09 may

The pheromone traps have been reported sporadically specimens belonging to other species (they reached only accidentally or if they show any preference for the white color of the trap).

CONCLUSIONS

1. Use the specific sex attractant pheromone traps, attractants for mass capture of males *Cameraria ohridella* Deschka-Dimić, and prompted a flight duration of leaf mining moth chestnut between 27 days (in 2014) and 34 days (2015).
2. Capturing the mass of males help reduce pest biological reserve, if applied consistently each year.
3. In the Husi -Vaslui, chestnut leaf miner moth, developed 3 generations in 2014-2015 .
4. The hibernating generation adults begin their flight in the first half of May; first generation of flying adult start in the first decade of July and the last generation flight starts in the second decade of August.
5. The maximum flight curve is performed in 11 to 14 days of the start of the flight.
6. The first generation were first reported in the last days of May, the second generation in the last decade of July and last generation mines in the first days of September.
7. Duration of larval stage was 23-26 days from the first generation of 19-21 days in the second generation and 19-20 days from the last generation.
8. The pupal stage is phased in over a period of 9-10 days to 7-9 days the first generation and the second generation.
9. The duration of the total development of the first generation was 52-58 days and the second generation of 42-49 days.
10. It is worth noting that overlapping generations summer, flying adults is a continuous flight between July and August.
11. In the last decade of September were recorded hibernating pupae generation.

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