

BIOLOGY, ECOLOGY AND INTEGRATED CONTROL OF THE SPECIES *Stigmella mallela* Stt. (marbled ore), PEST IN THE APPLE PLANTATION FROM NEAMT COUNTY

BIOLOGIA, ECOLOGIA ȘI COMBATERICA INTEGRATĂ A SPECIEI *STIGMELLA MALELLA* STT., DĂUNĂTOR ÎN PLANTAȚIILE DE MĂR DIN JUDEȚUL NEAMȚ

ZAMA AGATA¹, FILIPESCU C.², GEORGESCU T.²,
TALMACIU NELA², BERNARDIS R.²

¹Neamt county Phytosanitary Board

²University of Agricultural Sciences and Veterinary Medicine Iași

Abstract. *The researches carried out by the authors in the apple orchards revealed the data regarding the geographic distribution, the morphology, the biology and the ecology of this pest in Neamț's county conditions.*

The authors also present the integrated control through agrophytotechnical methods, biological methods (the parasites), the use of traps with specific sexual pheromones of the light and alimentary ones as well as the chemical control through selective and ecological products.

Rezumat. *În urma cercetărilor efectuate în plantațiile de măr asupra speciei *Stigmella mallela* Stt., autorii prezintă date privind răspândirea, morfologia, biologia și ecologia acestui dăunător în condițiile județului Neamț. De asemenea, se prezintă combaterea integrată prin măsuri agrofitehnice, biologice (paraziți), utilizarea capcanelor cu feromoni sexuali specifici, a curselor luminoase și alimentare, precum și chimic cu produse selective, biologice.*

INTRODUCTION

Stigmella mallela Stt. (Lepidoptera-Stigmellidae)- liniar ore, is spread all over Europe and Little Asia, being harmful to the apple. In our country, it was pointed out in fauna by Caradja Aristide (1899) and by Alexinschi Alexei (1950).

As pest in the apple plantations it was pointed out by Dobreanu Ecaterina (1937) and biotechnological and control studies were approached by Draghia I., in various works (1966-1986); as well as Hertug Maria (1981-1986); Susea Sonica (1981); Popa Paul (2000) and so on.

Butterflies have sizes from 4 to 7 mm; the body and the wings are of dark brown colour; the fore wings are foreseen with a white median, transversal, transparent strip; the posterior wings are fringed; the body is foreseen with a tuft of little orange hair; the egg is greenish and little flat.

The larva at its complete growth has 3-4 mm length and it is yellowish (figure 1.c). The pupa has 3-4 mm length and it is protected by a yellow cocoon, which previously becomes brown.

METHOD AND MATERIAL

Leaves attacked by larva have been collected; they have made growths in the lab and observations in nature regarding biology; as well as the use of the specific sexual ferromons (Atramal), light and alimentary strokes to worn about chemical treatments, and so on.

RESULTS AND DISCUSSIONS

Our researches in biology established that the species *Stigmella mallela* Stt. Hibernates in the phase of pupa, protected, in the leaves fallen in the soil superficial layers. The first butterflies appear in the conditions of Neamt county in 2001, between 04.24 (the 24th of April) and 05.19 (the 19th of May), at $\Sigma (t_n-t_0)=9^\circ\text{C}$.

Typically, the appearance of the butterflies in spring is phased, and their flight is observed in the sunny days, while in the rainy days and those with lower temperatures, they shelter in the crust cracks, among herbs or soil clods.

After pairing, females deposit 30-45 eggs, isolated, on the inferior part of the leaves during period 1.V-16.V at $\Sigma (t_n-t_0)=80^\circ\text{C}$. After a period of incubation which may last up to 8-10 days, according to temperature, out of them comes the larva.

The evolution of larva developed during period 14.V-5.VI, for 20-22 days at $\Sigma (t_n-t_0)=154^\circ\text{C}$. When appearing, larva enter right into the leaves, where they feed with the mesophyllum between the two epidermis, building a specific gallery (mine) and this is where the name of "ring ore" comes from.

At its complete growth, larva does not abandon a leaf to enter another, even if the first leaf becomes insufficient to feed from, having smaller shape. At this phase, the larva abandons the leaf and goes down into soil, the the superficial layer to a depth of 0,5-1,0cm, where it transforms into pupa, in a protective silky cocoon, during period 4.VI-16.VI at $\Sigma (t_n-t_0)=236^\circ\text{C}$. If the soil is to wet, the making of the cocoon is impossible and the larva may die.

After 10-12 days, as the pupa phase may last, butterflies appear, and they will give birth to the second and the third generation, which grows the same way.

This way, the 1st generation (G_1) grows in May-June; the 2nd generation (G_2) in June-July, the 3rd generation (G_3) in August-September. The progressive cycle diagram of the species *Stigmella mallela* Stt. (original).

After our researches upon the ecology of this species, regarding the biological reserve in the autumn of 2001-2002 from the apple plantations in Piatra-Neamt was of 21,08% in 2001 and 21,45 in 2002.

In Bicaz, the biological reserve was of 10,10% in 2001 and of 11,54% in 2002. Also, in Roman city the biological reserve was of 25,22% in 2001 and of 27,86% in 2002. The greatest biological reserve was signaled in Roman city, followed by Piatra-Neamt and Bicaz. In all these cases, they recommend measures to preventing the attack of these species, to be kept under the level of PED, which is of 30 mines/100 leaves (table 1).

Table 1

**The biological reserve of the species *Stigmella mallela* Stt.
in various cities from Neamt county**

City	Biological reserve						Mean %	
	G ₁		G ₂		G ₃		2001	2002
	2001	2002	2001	2002	2001	2002		
Piatra-Neamt	17,8	27,42	23,78	18,09	21,25	22,45	21,08	21,45
Bicaz	8,7	10,2	12,40	16,04	9,2	8,4	10,10	11,54
Roman	21,7	32,4	28,08	24,7	25,06	25,05	25,22	27,86

As for the attack frequency (F%) observed in the same city from Neamt county in 2001 and 2002, they got to the following data (table 2).

Table 2

**The frequency of the attack (F%) of the species *Stigmella mallela* Stt.
in different cities from Neamt county in 2001 and 2002**

City	Biological reserve						Mean %	
	G ₁		G ₂		G ₃		2001	2002
	2001	2002	2001	2002	2001	2002		
Piatra-Neamt	14,05	19,08	16,03	16,06	15,04	18,04	15,04	17,72
Bicaz	8,04	10,04	7,02	6,03	7,02	9,01	7,36	8,36
Roman	24,02	30,50	31,01	28,04	29,05	32,08	28,02	30,20

The frequency of the attack in Piatra-Neamt city was of 15,04 in 2001 and of 17,72% in 2002.

In Bicaz it was of 7,36 in 2001 and of 8,36% in 2002. Also, in Roman it was of 28,02% in 2001 and of 30,20% in 2002.

We observe that from this point of view of the greatest frequency of the attack was in Roman, followed by Piatra-Neamt and then Bicaz.

The different behaviour of this species frequency in the 3 cities is tightly connected to the microclimates specific for the 3 cities: mountaneous (Piatra-Neamt); undermountaneous (Bicaz) and hills and fields (Roman), where the temperature, the moisture, the precipitations play a great role in the evolution of these species, which, in some propitious conditions, may exceed PED.

As for the attacked plants and the pest way, we mention that the species *Stigmella mallela* Stt., both in the world and in our country, has been signalled only in the apple plantations. The larva, during its growth, bites a mine, first right, narrow, which gets wider then.

On a leaf we may identify 6-12 mines, and in some cases even 35 mines. If 2 mines meet a larva must enter deeper and pass under another mine.

In its way the larva passes through the secondary ribs and even through the main one, so that the leaves turn yellow, even with only 1-2 mines a leaf (figure 1.e).

The integrated control has been done by:

- Agrophytotechnical measures: collecting and burning of the fallen leaves, followed by autumn or spring ploughing, which may have a very important contribution to the biological reserve reduction (larva, pupa) of these species.
- Biological measures, by creating proper life conditions of the parasites from Hymenoptera class, Braconidae and Chalcididae family); by tilling aromatic

and melliferous plants in the orchard, from the Umbeliferous family and so on, also by using the specific sexual ferromone ATRAMAL, or other lighting or elementary sources.

- Chemically, in 2001, in Piatra-Neamt they experimented the products Decis 2,5 EC (0,025%); Lannate 90WS (0,05%); Rimon 10 EC (0,06%); Dimilin 25 WP(0,03%) and Carbetox 37 EC (0,30%), (table 3).

The efficiency of these products was very good, leading to productions of 26,8 tones/hectare (Dimilin 25 WP-0,03%); 26,8 tones/hectare (Decis 2,5 EC-0,025%) and Rimon 10 EC-0,06%) as opposed to the witness where the production was of only 22,5 tones/hectare, realizing benefits between 4,0 and 4,3 tones/hectare.

Table 3

The efficiency of some chemical products in the control of the species *Stigmella mallela* Stt. in Piatra-Neamt in 2001

No.	Product	Dosis	F%			Production t/ha
			G ₁	G ₂	G ₃	
1	Decis 25 EC	0,025	17,17	23,4	21,6	26,8
2	Lannate WS	0,05	16,9	22,8	20,7	26,6
3	Rimon 10 EC	0,06	17,6	23,5	21,9	26,8
4	Dimilin 25 WP	0,03	18,6	23,9	22,1	26,4
5	Carbetox 37 EC	0,30	17,3	22,1	19,9	26,7
6	Untreated witness					22,5

CONCLUSIONS

The species *Stigmella mallela* Stt., in the conditions of Neamt county has 3 year generations (G₁ April-May; G₂ in June-July, G₃ in August-September) and hibernates in the phase of pupa in the fallen leaves, in the superficial layer of the soil.

The greatest biological reserve was signaled in Roman(25,22% in 2001 and of 27,86% in 2002), followed by Piatra-Neamt with 21,08% in 2001 and 21,45% in 2002) as well as of Bicaz with 10,10% in 2001 and with 11,54% in 2002.

The greatest frequence of the attack (F%) was registered in Roman (28,02% in 2001 and 30,20% in 2002) followed by Piatra-Neamt and then by Roman.

In the integrated control they applied agrophytotechnical, biological (parasite) measures; lighting and elementary traps with ferromones. Within the chemical measures following products were experimented: Decis 25 Ec (0,025%); Lannate 90 WS (0,05%); Rimon 10 EC (0,06%); Dimilin 25 WP (0,03%); Carbetox 37 EC (0,30%), which were very efficient, leading to productions between 26,4 tones/hectare-26,8 tones/hectare, with benefits between 4,0 and 4,3 tones/hectare, as opposed to the witness which obtained a production of 22,5%.

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