THE DYNAMICS OF APPLE SCAB ATTACK – *VENTURIA INAEQUALIS (CKE.) WINT.* IN THE ORCHARDS OF APPLE FROM SIBIU COUNTY, IN THE PERIOD 2006-2008

DINAMICA ATACULUI DE RAPĂN – *VENTURIA INAEQUALIS (CKE.) WINT.* ÎN LIVEZILE DE MĂR DIN JUDEȚUL SIBIU, ÎN PERIOADA 2006-2008

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Abstract: *The research presented in this paper includes the pathogenetical agents Venturia inaequalis (Cke.) Wint, which causes the brown maculation of the apple's leaves and the scab attack on the fruits and sprouts of the apple Malus pumila. One has observed the action of the fungus Venturia inaequalis (Cke.) Wint to certain environment factors (temperature, atmospheric humidity, rainfall and the phenological stages of culture. As a result of the infection, one may observe the moment of the attack. They were correlated to the apple's phenological phases with meteorological data and the biology of the fungus (warning criteria) in order to issue warning bulletins. 'Bulletin warning' contains: the pest agent for which the warning is issued, the culture, the necessary conditions for the treatment, the recommended products for the plant protection, dose appliance (commercial substances/ ha), the optimum period of the treatment, special recommendation concerning the environmental protection, the observance of security standards and animal protection, warning the bee breeders concerning the phytosanitary treatments during the mentioned periods.*

Rezumat: *A fost obesrvată acţiunea ciupecii Venturia inaequqlis (Cke.)Wint la anumiţi factori de mediu (temperatură, umiditate atmosferică, precipitaţii) şi fazele fenologice a culturii. Ca rezultat al infecţiei, poate fi observat momentul - atac. Atacul este reprezentat ca valoare de atac prin intermediul frecvenţei, intensităţii şi a gradului de atac. Observaţii au fost efectuate în perioada repausului vegetativ şi în perioada de vegetaţie a mărului, la soiul Ionathan, în perioada 2006-2008, în ceea ce priveşte biologia ciupercii Endostiqme inaequalis (Cke) Wint. şi dinamica ataculuibolii pe frunze şi fructe. Prin monitorizarea dinamicii ataculuide rapăn, în perioada 2006-2008 în livezile de măr din judeţul Sibiu, se pot aplica ştiinţific măsurile de protecţie fitosanitară cele mai adecvate, prin utilizarea tehnologiilor de înalt randament, eficiente şi nepoluante, care să asigure o recoltă de fructe autohtone, cu gustul şi savoarea caracteristice, dar şi cu o încărcătură de reziduuri cât mai redusă, în cooncordanţă cu legislaţia în vigoare, armonizată cu cea a U.E, pentru menţinerea sănătăţii consumatorilor.*

Key words**:** *Plant protection, Atack ,Degree of attack*
Cuvinte cheie**:** *Protecţia plantelor, Atac, Grad de atac*

INTRODUCTION

In the orchards with sensitive kinds from the classic assortment, the trees and the fruits of apple can be infested with a large number of species of pathogenic agents, which may cause considerable damages. Among these, in the years with normal climatic conditions, the

brown taint of the apple's leaves and the scab attack on the fruits and sprouts of the apple – *Venturia inaequalis (Cke.) Wint*. represents a restrictive factor in the productivity increase of the plantation, being a permanent preoccupation for the fruit growers and the specialists in plant protection. The noxiousness of apple scab attack consists in a considerable decrease of the photosynthetic surface area of the trees, the quantitative and qualitative depreciation of the harvest, additional expenses for chemical treatments on plantations, augmentation of environmental pollution risk and of pesticide residue production.

During the favorable years in the evolution of this fungus, one can suffer losses in the unkempt orchards between 60-90% and if the situation repeats, in the next 2-3 years the disparagement of the plantation is possible.

The fungus which produces the disease is an optional parasite with two phases of evolution – a parasitical one (on trees in the vegetation period) and a saprophytic one (on the fallen leaves on soil where it develops its sexuate form - perithecia with asci and ascospores.

From a year to other it is transmitted through: - mycelium induces resistance and stays on the attacked organs until next spring; it produces conidia (the sexuate form);

- perithecia – the sexuate form – which, in the spring, produce ascospores suitable for the new organs;

- summer conidia which exist on the attacked organs from the previous year.

During spring and summer, in a tree crown as well as from a tree to another, infections are also transmitted by the summer conidia concomitantly with the ascospores. In this case, infection reaches high levels especially during rainy springs (the critical period for the host plant being April, May and June).

To reduce the degree of attack, hygienic measures of the culture play an important role followed by the phytosanitary treatments. Protection program in the apple culture must be adapted every ecological zone from the county's perimeter.

MATERIAL AND METHODS

The biological material used in experiments was composed of leaves and fruit of apple during the growing culture, and only leaves during vegetative rest. The material was taken from the apple orchards in the areas Agnita, Apoldu Upper, Dumbrăveni and Sibiu. There were used phytopathological and mycological classical methods of isolation and identification of pathogens (HULEA, 1969).

The research is the classic account of interference with modern research performed in the context of the sustainable development of horticultural agrosystem of the apple orchards and can lead to research on modern high quality crops and the residues of phytosanitary substances in fruits, according to the law. Microscopic laboratory analyses were performed in the diagnosis laboratory of the Phytosanitary Unit from Sibiu.

RESULTS AND DISCUSSIONS

As relief and climatic conditions in the county of Sibiu are very diverse, the county is divided into 4 microclimate areas: Agnita, Upper Apoldu, Dumbrăveni and Sibiu.

The research was conducted in representative orchards for the mentioned areas, to Ionathan species (sensitive to scab attack) during 2005-2008. In the orchards in which observations were made the specific technology was applied to the culture.

One has followed the evolution of the pathogen agent *Ventura inaequalis (Cke.) Wint*. on 3 trees, 5 sprout / tree, representative trees of the mentioned area.

To understand the evolution of *Ventura inaequalis fungus (Cke.) Wint* and its attack in the ecopedoclimatic conditions in the county one have taken into account:

1. The biological reserve from previous years – during fall before the fruit harvest

(table 1, 2, 3, 4)

2. Meteorological data of the microclimate (table 6)

3. Phenology of apple culture depending on the microclimate (table 7).

Observations began after the leaves fall in October 2005, continuing into spring, to observe the fruit buds (because they are the first to start growing) the vegetative buds (from branches of 2-3 years, and on twigs and sprouts).

1. THE BIOLOGICAL RESERVE OF THE PEST AGENT

Table 1

The biological reserve in the fall of 2005-2007 for Upper Agnita area

AGNITA AREA	SCAB ATTACK ON :					
	leaves			fruit		
	F %	I %	D.A. %	F %	I %	D.A. %
2005	81	16.2	13.1	15	0.7	0.10
2006	75	19.4	14.5	18	0.9	0.16
2007	84	13.3	11.1	19	0.8	0.15

Table 2

The biological reserve in the fall of 2005-2007 for Apoldu de Sus area

UPPER APOLDU AREA	SCAB ATTACK ON :					
	leaves			fruit		
	F %	I %	D.A. %	F %	I %	D.A. %
2005	93	16.3	15.1	9	1.4	0.12
2006	87	14.9	12.9	6	0.9	0.05
2007	83	10.6	8.7	6	0.3	0.01

Table 3

The biological reserve in the fall of 2005-2007 for Dumbraveni area

DUMBRAVENI AREA	SCAB ATTACK ON :					
	leaves			fruit		
	F %	I %	D.A. %	F %	I %	D.A. %
2005	90	13.8	12.4	18	0.8	0.14
2006	84	14.1	11.8	11	0.9	0.09
2007	81	16.5	13.3	14	0.8	0.11

Table 4

The biological reserve in the fall of 2005-2007 for Sibiu area

SIBIU AREA	SCAB ATTACK ON :					
	leaves			fruit		
	F %	I %	D.A. %	F %	I %	D.A. %
2005	83	12.4	10.2	5	0.8	0.04
2006	76	13.8	10.4	6	0.6	0.03
2007	73	16	11.6	3	1	0.03

Frequency (F%) - is the relative number of plants or plant organs attacked (n) reported to the number of plants or plant organs observed (N). **F% = n x 100 / N.**

The intensity of attack (I%) is the relative value which stands for the coverage or extension of the attack on the plant, reporting the attacked surface to the total observed surface.

$$\mathbf{I\% = \Sigma\ (i \times f) / n}$$

i - percentage of the attack cover

f - number of cases of attack (1-6)

n - total number of attack cases

The degree of the attack on the plant (A.D. %) – stands for the extension seriousness attack on the culture or the total number of plants, which were observed. **D.A.% = F x I / 100.**

To frame the attack one used its evaluation from the" List of the main pathogen agents of cultivated plants, and the evaluation of their attack" issued by the Central Laboratory for Phytosanitary Quarantine, Bucharest (table 5).

Table 5

	ATTACK ON LEAVES				
	Low	Medium	High	Very high	Extremely high
A.D.	<10	10-25	25-50	50-75	>75

2. METEOROLOGICAL DATA

Table 6

Meteorological data 2006-2008

AREA/ YEAR	AGNITA			UPPER APOLDU			DUMBRAVENI			SIBIU		
	2006	2007	2008	2006	2007	2008	2006	2007	2008	2006	2007	2008
T^0C	8.1	9.9	8.6	11.6	12.8	10.0	13..0	13.2	12.6	12.1	12.7	10.2
U%	85	82	81	87	79	79	86	86	77	83	79	72
P.P. l/mp	717.0	790.5	662.6	653,1	748,1	750,6	459,1	506.3	539.3	778,4	740,5	681.6

T^0C - Annual average daily temperature;

U.% - Annual average air relative humidity;

P.P. - Precipitation - Total liters / square meter.

In terms of average annual temperature Dumbrăveni area recorded the highest temperatures, followed by the area Upper Apoldu, Sibiu and Agnita .The temperature difference is higher during the spring months, highlighted in the evolution of c phenological stages of the culture and in applying phytosanitarium treatments at the proper time.

3. PHENOLOGICAL PHASES OF THE APPLE

Table 7

Phenological stages of the apple 2006-2008, Sibiu

NR. FAZEI	PHENOLOGICAL STAGE	DATA FROM-TO		
		2006	2007	2008
I.	Vegetative rest	- 16.03	- 01.03	- 06.03
II.	Buds swelling	17.03 - 11.04	01.03 - 20.04	07.03 - 13.03
III.	Unbudded	12.04 - 14.04	21.04 - 23.04	14.03 - 22.03
IV.	Beginning of leaves growing	15.04 - 16.04	24.04 - 10.04	01.03 - 14.03
V.	Leaved period	17.04 - 21.04	11.04 - 15.04	15.04 -16.04
VI.	Inflorescence's raising	22.04 - 25.04	16.04 - 20.04	17.04 - 18.04
VII.	Inflorescence spreading	26.04 - 03.05	21.04 - 29.04	19.04 - 21.04
VIII.	Blossoming beginning	04.05 - 05.05	24.04 - 25.04	22.04 - 9.04
IX.	Blossoming	06.05 -11.05	26.04 - 02.05	10.05 -15.05
X.	Beginning of petals spreading	12.05 -15.05	30.05- 04.05	16.05 -18.05
XI.	Petals spreading	16.05 -	06.05	19.05
XII.	Peanut-like fruit	12.06	25.05	02.06
XIII.	Diameter fruit 2.5 cm	13.06	04.06	15.06
XIV.	Normal fruit size	30.08	25.08	28.08
XV.	Harvest	15.09	15.09	17.09

OBSERVATION CONCERNING KNOWLEDGE THE FUNGUS BIOLOGY

To determine the moment when perithecia appear on the leaves attacked by "brown maculation" in October (years 2006, 2007, 2008) one collected 800-1200 heavily attacked by leaf disease. Leaves were placed on the platform track with the attacked surface pointed

towards light. From December one has studied to binocular magnifying glass,15 leaves, 2 times per month, on the days when the ground was not covered with snow, to determine when perithecia appear (table 8).

After having examined perithecia one continued with the projection of mature ascospores on vaselined slides (figure1).

The supervision of projection on the slides was done like this: leaves which had a lot of perithecia were placed on the ground and 2 boards (pencils) were put on them and over then 5 vaselined slides were placed on the top. The vaselined part is oriented towards the leaf to capture ascospores.

In order to know the dynamics of ascospores projection, this phenomenon was checked every 3 days and on rainy days, every day. Slides were microscopically studied and every leaf's number of ascospores was registered. When perithecia were cleared leaves were replaced by others.

The projection of ascospores began 'before the flower unbudded' continuing until after the blossoming.

The data when the first maculate of scab attack appeared on leaves correspond to the phonological stages every single year on studing the phenomenon.

Figure1. The ascospores projection on slides

Table 8

Data when perithecia appear on leaves

YEAR	DATA WHEN PERITHECIA APPEAR ON THE EXAMINED LEAVES			
	AGNITA	UPPER APOLDU	DUMBRAVENI	SIBIU
2006	15 February	10 January	03 January	05 January
2007	04 February	06 January	08 January	14 January
2008	08 February	14 January	09 January	18 January

Table 9

Primary infection

YEAR	DATE OF FIRST APPERANCE OF SPOTS ON THE LEAF 'BROWN MACULATION'			
	AGNITA	UPPER APOLDU	DUMBRAVENI	SIBIU
2006	21 May	3 May	7 May	9 May
2007	28 May	12 May	9 May	18 May
2008	17 May	8 May	3 May	10 May

The infection was made at 8^0C, the optimum temperature being 15-26^0C.

CONCLUSIONS

From the undertaken research and the obtained results one distinguished:

- Perithecia were identified on the leaves since January;
- Aging and projection of ascospores on vaselined slides (the crown of trees) was done during the phenology stage of the applecalled 'the bud swelling';
- Infection produced at a temperature between 8-26^{0}C optimum being 15 and 26^{0}C, the leaves must be wet, the projection of ascospores being subjected to rain and dew;
- The first symptoms of ' brown maculation ' on leaves in all three years were visible during the phonological phases 'petals spreading' and peanut-like fruit';
- In orchards where culture technology is not neglected, at the end of September D.A produced by *Venturia inaegualis (Cke.) Wint.*to the Ionathan species is low and medium, which shows that the mycosis is difficult to keep below the limit of Economic Threshold for Pest;
- In apple orchards where one does not apply every phase on the culture technology, the degree of attack (D.A.) recorded during the three years reached the levels 'high' and 'very high';
- Based on these results I consider that the biggest losses are caused by infections before bloom, during bloom and immediately after the apple's blooming;
- Phytosanitary treatment in the phonological phase 'before bloom' is the basic treatment which has the role of protecting the leaves and the sprouts against primary infection during blooming when in all the study years massive projections of ascospores were made;
- The protection program of the apple culture must be adapted for each ecological area of the county's perimeter to establish its calendar for the phytosanitary treatments;
- The development of appropriate treatment schemes based on prognosis and warning for fighting the pest agents thus the natural biocenotical equilibrium is maintained as well as the public health.

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