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COMPORTAREA UNOR SOIURI DE MĂR CULTIVATE ÎN SISTEM SUPERINTENSIV LA FOCUL BACTERIAN AL ROZACEELOR

BEHAVIOR OF SOME APPLE VARIETIES GROWN UNDER SUPERINTENSIVE SYSTEM TO FIRE BLIGHT (*ERWINIA AMYLOVORA*) ATTACK

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Abstract

The fireblight of rosaceous species is a very important disease for fruit growing in general and for the pome fruits species cultivation as well, especially under the conditions of expansion of superintensive training systems and in the context of current climate changes. During 2016-2018, the reaction of some performant apple cultivars grown under superintensive system to the attack of fireblight (*Erwinia amylovora* Burill Winslow) was assessed and was dependent on the variety/rootstock combination, trees age, and environmental conditions, presence of the pathogen and its aggressiveness and management of some technological links. Our study revealed that the most sensitive cultivar/rootstock combinations were 'Dalinco/Pajam1', 'Topaz/M9', 'Topaz/T337', 'Dalinbel/T337' and 'Dalinette/M9' (11 years old). At the other end, the most resilient combinations were 'Golden Orange/T337', 'Ariane/M9', 'Iniţial/M9', 'Rebra/M9', i 'Rustic/M9' (11 years old) and 'Mitchgala/M9' and 'Golden Delicious/M8' (3 years old). In the future, to overcome their sensitivity to fireblight, the varieties 'Dalinco', 'Dalinbel', 'Dalinette' and 'Topaz' might be grafted on M7 or other tolerant low vigor rootstocks.

Cuvinte cheie: măr, focul bacterian, agresivitate, soi portaltoi, vârstă, verigi tehnologice.
Key words: apple, fireblight, aggressiveness, cultivar rootstock, age, technological links

1. Introduction

Apple crop. The economic importance

In temperate areas of the Globe, apple is the main tree fruit species due to the role of apples in human nutrition and due to certain agrobiological features such as: it is well adapted to the temperate climate, with the extreme values of the meteorological parameters and the low fertile soils, has the highest harvest index of all fruit species (Koslowsky et al., 1991), its fruit supports easy transportation at great distances and are a valuable source of raw material for the food industry.

According FAO, in 2016, the world total harvested area was estimated at 5.293.340 ha and the apples production was estimated at 89.329.179 tones. In average, 31% annual apple production is obtained in Europe, 31% in Asia, 14% in North America, 6% in South America, 3% in Africa and the rest on other continents. The top 10 apple producing countries are China (44.447.793 t), USA (4.649.323 t), Poland (3.604.271), Turkey (2.925.828), India (2.872.000 t), Iran (2.799.197 t), Italy (2.455.616), Russian Federation (1.843.544), France (1.819.762) and Chile (1.759.421 t).

In Romania the harvested area reached 55.528 ha and apple production was estimated at 467.259 t, which marketed was an important source of incomes. Under the conditions of expansion of superintensive training and growing systems and in the context of current climate changes, it is vital to know the behavior of new released or introduced apple varieties to pests and diseases attack, prior the establishment of the new high-density orchards, and to better manage the existent ones.

Fireblight spreading, host plants and main symptoms

All over the World, the apple production sector can be affected by many pest and diseases which causes serious damages and economic looses.

Among them, fireblight is one oldest and most devastating. Under ideal conditions it can destroy an young apple or pear orchard or nursery in a single season. Older trees can survive several years, even with continuous dieback (Kari P., 2017; Ivey L. M., 2016**;** Biggs A.R. et all, 2008; Babadost M., 2006; Hartman J., Hershman D., 2002; Ritchie D. F., Sutton T.B. 2002; Steiner P.W., Van der Zwet T., Biggs A.R., 2000; Van der Zwet T., and Keil L.H., 1979; Amzăr V. and Branişte N., 2000; Amzăr V. and Ivaşcu A., 2003; Severin et all, 1985, 2007; Teodorescu G. et all., 2007; Tomşa M., Tomşa E., 2003).

In Romania, the disease was spoted first in 1991 (Amzar V. et all., 2003; Severin V. and Iliescu H, 2000).

The causal agent, *Erwinia amylovora* Burril Winslow, *Bacteriophyta, Enterobacteriaceae*, a gram negative type bacteria, was spotted first time in England in the 18th Century but nowdays it is present

in many apple growing countries. Due its ecological plasticity, the pathogen attacks more than 75 host plant species from 30 genera, many of fruit species genus (*Malus, Pyrus, Cydonia, Sorbus, Mespilus, Cerasus, Prunus triloba var. plena, Aronia, Rubus* and *Fragaria*) and a wide range of decorative species as well (Kari P., 2017; Villani S., 2017, Ivey L. M., 2016; Koski R.D., Jakobi W.R., 2014).

The pathogen overwinters in diseased shoots and surrounding bark plagues (Ivey L. M., 2016**,** Biggs A.R. and Steiner P.W., 2000) and during the vegetation period, the bacteria are spread on host plants bay insects, bees, strong winds, rains water and human intervention in the orchard.

On the host plants, the disease symptoms were noticed on all aerial parts, and under favorable condition progress in an exponential manner.

During the warm springs, bacterial ooze drops appear first on the flower stalks. The flowers which first hydrolyzed become brown, are fading and soon turn in black. If daily medium temperature is higher than 16 °C, the infected flowers are entirely colonized in few minutes (Longstroth M., 2013, Biggs A.R., Steiner P.W., 2000). The leaves are affected starting with the petiole and the mid vein, and then the infection spreads between leaves and along the growing shoots which takes the shape of 'J' letter and turn in brown (Ivey L. M., 2016).

In the wet periods, on the attacked shoots of sensitive cultivars, bacterial ooze droplets, having white, dark-yellow, orange or even red colors suddenly appears. On the shoots, the infections become visible within 167 days, with average temperatures higher than 13 °C. (Steiner P.W. 2000).

On the green fruits the disease symptoms appears after hails and thunderstorms and the heavy infected fruits becomes brown in less than two weeks.

During the vegetation period, the bacteria enter into the host using natural gates like wounds, broken stalks or shoot tips, stomata, lenticels. On the sensitive varieties, the infection move down to the phloem, to the trees limbs and trunks producing plagues and exudates and the death of entire trees.

Researches regarding fire blight and its confinement**.**

In order to restrain and control the disease spread and the consequent damages, intensive researches are carried out in many apple growing countries and in our Country as well in the fields of: assortment and rootstocks evaluation, pathogen biology and epidemiology, early detection and risk assessment, monitoring of the pathogen propagation into the ecosystems, technological methods aiming to reduce varieties susceptibility, use or adequate plant protection products, define the behavior and breeding of new tolerant or resistant varieties (Table 1).

The aim of this work was to evaluate some performant apple cultivars grown under superintensive system, to better know their behavior on the attack of fireblight (*Erwinia amylovora* Burill Winslow), to find correlation between some biochemical traits of shoots and fruits and the components of the attack and to define a set of measures to prevent and control the fireblight attack.

2. Material and methods

The researches were conducted during 2016-2018 at Research Institute for Fruit Growing Pitesti Romania on more than 40 apple varieties recently released or introduced in our Country.

Apple trees were grafted on six different low vigor vegetative rootstocks, grown under superintensive system with over 3000 trees /ha, trained as slender spindles and supplied with water and nutrients by fert-irrigation.

The experimental device was located on a plain terrain placed on the second terrace of the Arges River, on a low to medium fertile alluvial clay unit (more than 30% of clay; humus less than 1.7%; nitrogen index 0.33-1.43; PAL 1.3-2.5 mg/100g, but well supplied with potassium, up to 40 mg/100 g). Soil reaction is slightly acid (pH=5.8-6.8).

The orchard floor was covered with grass between the tree rows and cleared with total herbicides on stripes of 1.0-1.2 m wide, along the tree rows.

Trees fertilization was well balanced in nutrients by applying the recipe N_{200}-P_{240}-K_{280}-Ca_{20} /ha (1.0 : 1.2 : 1.4 : 0.2 ratio) and 4-5 foliar fertilizations with Polyfeed.

During the dry periods the experimental plots received 6-7 l water/ m^2/day.

The data related to local microclimat were collected using the semi-automate weather station WatchDog (Spectrum Technologies Inc.), and was stored, processed and analyzed using the facilities of MS Office Excel 2010 and Specware Pro 9.0 module for early warning.

Using this module, the risk of infections with fireblight was assessed using the Cougar scale (where '0'=no risk; '1'=low infection risk; '2'=medium infection risk and '3'=high infection risk).

At 23 most promising apple varieties, during the vegetation period, observations regarding the disease attack frequency and intensity were done using a modified Van der Zwet scale, where 10=healthy tree and 0=dead tree).

At the same promising apple varieties, additional assessments were done on: growing shoots pH; green fruits pH and electric conductivity (mV) as well as dry mater content of the fruits at the harvest time.

After the evaluations, additional sanitation works we done to remove the damaged shoots.

The experimental data were stored, processed and analyzed, using MS Office Excel 2010 facilities.

Pictures were taken with a Samsung E90 digital camera and processed with the free software Irfan View 4.25 and Photofiltre 7.0.2.

3. Results and discussions

3.1. Results on about the infection risk *Erwinia amylovora* on apple

The local microclimate data collected reveal that the years of the study (2016-2018) were very favorable for the fire blight attack on apples.

Assessment of the figure 1 shows that, in 2016 the most critical periods for possible infections were: end of April (Cougar risk=2.0), end of May (Cougar risk=2.0-2.5), June-July (Cougar risk=2.5=3.0) and the risk was maximum in August-September (Cougar risk=3.0).

Analysis of the figure 2 reveal that, in 2017 the most critical periods for possible infections were: May (Cougar risk=1.5-2) and June till September (Cougar risk=2.0-3.0).

Assessment of the figure 3 shows that, in 2018 the most critical periods for possible infections were: mid of April-mid of May (Cougar risk=2.0-2.5), mid of May till end of June (Cougar risk=3.0), July (Cougar risk=2.5-3.0) and August-September (Cougar risk=3.0).

3.2. Results on some biochemical parameters and behavior of perspective apple varieties to the fireblight attack

The results regarding some biochemical parameters of the shoots and fruits and behavior of some perspective apple varieties to the fire blight attack are presented in the Table 2 and figures 4-6.

Sands and McIntyre in 1975 and Van der Zwet T. and Keil L. H. in 1979, associated the cells pH lower than 4.0 with the leaves tolerance to the infections with fireblight (*Erwinia amylovora*).

It can be observed that, during the study period, the growing shoots pH ranged between 5.2 and 5.9 and the young fruits pH between 2.9-3.9.

As regard the young fruits cells conductivity, on the fruits of 11-12 years trees old, the indicator ranged between 190 mV at 'Rustic' variety and 240 mV at 'Golden Orange' variety. On the fruits of 3 years old trees, this indicator oscillated between 218 mV at 'Jonaprince' variety and 236 mV at 'Golden Delicious' and 'Golden Reinders' varieties (see also figure 4).

The assessments carried out during the study period revealed that, the apple young leaves and fruits are tolerant at the early infections with the *Erwinia amylovora* bacteria, as long as the cellular juice electric conductivity oscillate between 180-250 mV, and cellular juice pH oscillate between 2.5 and 4.5.

The fruits dry mater content at the harvest moment ranged between 9.11 and 14.66 °Brix on the fruits of 11-12 years trees and 12.0 and 13.8 °Brix on the fruits of 3 years trees.

Evaluation of the Figure 5 reveal that the most severe attacked apple varieties were: 'Dalinco/Pajam1' (note 3.00), 'Topaz/M9' (note 6.98), 'Topaz/M337' (note 7.33), 'Idared/M9' and 'Braeburn/M9' (note 7.50), 'Dalinred/M9' (note 7.79) and 'Dalinbel/M9' (note 8.38).

Assessment of the Figure 6 suggest that, according the attack frequency, the most affected apple varieties were: 'Dalinco/Pajam1' (F%=17.63), 'Topaz/M9' (F%=11.77), 'Idared/M9' (F%=11.0), 'Braeburn/M9' (F%=10.0), 'Dalinbel/M9' (F%=8.81), 'Dalinred' (F%=2.40).

3.3. Correlations between some biochemical traits of shoots and fruits and the fireblight attack components

The amount of accumulated data for the 23 perspective apple varieties offer us to the possibility to find some correlations between some biochemical traits of shoots and fruits and the components of the fireblight attack.

Assessment of the Figure 7 shows that the increase of the shoots cellular juice pH from 5.2 up to 6.0 and assimilates accumulation favored the intensity of the fireblight attack, the correlation found was **r=0.8259.** A strong correlation (**r=0.6412**) was also found between shoots cellular juice pH and the pathogen attack frequency (Figure 8).

Evaluation of the Figure 9 reveal a strong correlation between young fruits cellular juice pH and fruits dry mater content at the harvest time. (**r=0.8420**).

In the Figure 10 one can observe that fireblight attack frequency partially influenced the fruits dry mater content at the harvest time. The correlation value found was **r=0.4538**.

3.4. Results regarding the behavior of perspective apple varieties on the fireblight attack

The data and information accumulated during the study period allow us to classify the 23 perspective apple cultivars in five groups, according their behavior to the fireblight attack on lateral shoots (Table 3) and to define a set of technological measures aiming to prevent and control the fireblight attack in apple orchards trained under superintensive system and for better protect the new established ones.

According their behavior to fire blight attack on lateral shoots, the perspective apple cultivars can be clasified as follow: *very susceptibile*: **'**Dalinco', 'Fuji', 'Granny Smith', 'Jonathan' (note 2--4); *susceptibile*: 'Mutsu', 'Auriu de Bistriţa' (note 5); *medium tolerant*: **'**Golden Delicious', 'Auriu de Bistriţa', 'Idared', 'Braeburn', 'Fuji Kiku Clone 8.', 'Dalinbel', 'Topaz' (note 6--7); *Tolerant:* **'**Golden Lassa', 'Golden Reinders', 'Goldrush', 'MitchGala', 'Nured Jonathan', Prima, 'Romus 5', 'Ariwa', 'Dalinbel', 'Crimson Crisp', 'Dalinred', 'Dalinette', 'Enterprise', 'Hilwell' (note 8--9) and *"resistant":* **'**Florina', 'Golden Orange', 'Aura', 'Bistriţean', 'Ciprian', 'Goldprim', 'Jonaprim', 'Starkprim', 'Iniţial', 'Rebra', 'Redix', 'Rustic', 'Romus 3', 'Romus 4', 'Ariane', 'Falstaff', 'Pinova' (note 10).

Based on the accumulated information and data, we propose a set of technological measures aiming to prevent and control the fireblight attack in apple orchards trained under superintensive system and for better protection of the new established ones including:

- Monitoring the plots with 'very susceptible', 'susceptible' or even medium 'tolerant' varieties as well as the proximity areas;
- Use of the healthy planting material, 'tolerant' or 'resistant' to fire blight to establish new high-density apple orchards.
- To stand with their sensitivity to fireblight, in the future, the varieties 'Dalinco', 'Dalinbel', 'Dalinette' and 'Topaz' might be grafted on M7 or other tolerant low vigor rootstocks.
- The orchards pruning might be done as much as possible during the dormant period of the apple trees.
- When orchard sanitation is needed, **disinfection is mandatory** for the tools used for pruning, using absolute ethylic alcohol or sodium hypochlorite, undiluted commercial product) and protection of the resulted wounds, using special wax.
- The infected wood resulted from sanitation pruning must be collected, removed and burned entirely.
- For the orchards established in growing areas with infection potential for very sensitive and sensitive apple cultivars, the fertilization and irrigation must be conducted very carefully; drip irrigation is preferred.
- In such apple growing locations it is very important to implement a preventive program of treatments designed to reduce the inoculum reserve and to control the damaging insects acting as fireblight vectors. This program should include:

-Fungicides based on: copper, aluminium fosetil, mancozeb, acetometil-S-benzolar), etc.

-Insecticides based on: abamectin, acetamiprid, flonicamid, spinosad, tau-fluvalinat, etc.

-Biological products based on antagonists of the *Erwinia amylovora* bacteria**.**

4. Conclusions

During 2016-2018, the meteorological conditions were very favorable to infections produced by *Erwinia amylovora* on apples.

The apple varieties behave different on the fireblight infections according their genitors, the affected organ (flowers, bark, shoots, fruits) or the entire tree/rootstock combination, meteorological conditions and local microclimate, the growing system and applied technology, production level, etc.

Young apple leaves and fruits are tolerant to the early infections with the *Erwinia amylovora* bacteria*,* as long as *the cellular juice electric conductivity* oscillates between **180-250 mV** and the *cellular juice pH* ranges between **2.5** and **4.5.**

The *cellular juice pH* increase up to **6.0,** and the assimilates accumulation, encourage the pathogen attack intensity.

Four correlations, statistically insured were determined: young shoots pH -- fireblight attack intensity, **r=0.8259**; young shoots pH -- fireblight attack frequency, **r=0.6412**; young fruits pH -- soluble dry matter content of fruits at harvest time, **r=0.8420**; fireblight attack frequency -- soluble dry mater content of the fruits at harvest time **r=0.4538**;

The data and information accumulated during the study period allow us to classify 23 perspective apple cultivars into five groups, according their behavior to the fireblight attack on lateral shoots (Table 3) and to define a set of technological measures aiming to prevent and control the fireblight attack in apple orchards trained under superintensive system and for better protection of the new established plantings.

To stand with their fireblight sensitivity, in the future, the varieties 'Dalinco', 'Dalinbel', 'Dalinette' and 'Topaz' might be grafted on M7 or other tolerant low vigor rootstocks.

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Figures and Tables

Table 1. Research efforts regarding fireblight on apples

N.	Country	*Universities / Plant Pathology Laboratories*	Research units	National authorities
1.	USA	Cornell University, NY Pennsylvania State University, PA University of Maryland, MD North Carolina State University, NC Michigan State University, MI Illinois State University, IL West Virginia University, WV University of Kentucky, KY Washington State University, WA Oregon State University Corvallis, WA	USDA Agricultural Experiment Station Geneva, NY, USDA Appalachian Fruit Research Station Kearneysville, WV USDA National Clonal Germpalsm Laboratory, Beltswille MD USDA National Clonal Germpalsm Laboratory, Corvallis OR	Plant Quarantine Office, Beltswille, MD *APHIS*
2.	CANADA	University of British Columbia	Harrow Research Centre, ON	OMAFRA
3.	AUSTRALIA		Intitute for Horticulture Development, Victoria	
4.	NEW ZEALAND		Horticulture and Fruit Research Institute, Havelock	
5.	UK		Horticulture Research International, East Malling	
6.	GERMANY		IPK, Gatersleben Obst Genebank Pillniz, Dresden	
7.	ITALY	Universita di Bologna Universita delli Studi di Padova Universita di Ferrara	Instituto di Scienze Chimice Instiuto Sperimentale di Frutticoltura, Roma, SO Forli	
8.	FRANCE		INRA, Angers	
9.	SWITZERLAND		FAW Changins-Wädenswil Institute of Integrative Biology, Zurich	
10.	POLAND		INHORT Skiernievice	
11.	BELARUS		FRI Samokhvalovichy, PPRI Priliuky, Minsk;	
12.	ROMANIA	UASVM Bucharest, UASVM Cluj-Napoca	RIFG Piteşti; RSFG Bistriţa; RSFG Voineşti RDIPP Bucharest	LCCF Bucharest

Table 2. Some biochemical parameters of 23 perspective apple varieties grown under superintensive system and their behavior to the fireblight attack RIFG Piteşti Romania, 2016-2018

Nr	Variety / rootstock	Age [years]	PH of growing shoots	PH of young fruits	Young fruits juice electric conductivity [mV]	Fruits dry mater content at harvest *Brix	Attack frequency [F%]	Attack intensity Van der Zwet scale - modified [10-0]	Attack intensity [% shoots lenght]
1	DALINCO/ Pajam 1	11	5,20	3,70	214,00	14,66	17,63	3,00	100
2	TOPAZ / M9	11	5,80	3,00	215,00	13,50	11,77	6,98	100
3	TOPAZ / T337	11	5,80	3,00	215,00	12,81	9,58	7,63	100
4	DALINRED / T337	11	5,80	3,70	214,00	9,14	2,48	7,79	100
5	IDARED / M106	12	5,80	3,60	215,00	12,30	11,00	7,50	100
6	BRAEBURN M9	12	5,80	3,40	214,00	14,00	10,00	7,50	100
7	DALINBEL /T337	11	5,90	3,90	226,00	9,11	8,01	8,38	100
8	DALINETTE /T337	11	5,90	3,70	212,00	14,66	2,22	9,00	100
9	ARIWA / T337	11	5,80	2,90	214,00	11,26	2,30	9,22	100
10	GOLDEN LASSA /T337	11	5,80	4,00	218,00	9,38	0,21	9,43	100
11	CRIMSON CRISP /PI80	11	5,90	2,90	225,00	11,40	5,56	9,75	100
12	GOLDRUSH /PI80	11	5,90	3,30	223,00	13,52	0,05	9,97	100
13	MITCHGALA /M9	3	5,80	3,40	215,00	12,00	1,88	9,12	100
14	GOLDEN DELICIOUS / M9	3	5,90	3,50	236,00	16,00	0,88	9,33	100
15	GOLDEN REINDERS /M9	3	5,90	3,50	236,00	12,06	0,88	9,33	100
16	JONAPRINCE / M9	3	5,90	4,00	218,00	11,00	0,10	10,0	100
17	JONAGOLD / M9	3	5,80	3,40	220,00	13,80	0,10	10,00	100
18	ARIANE /M9	11	5,90	3,30	235,00	11,70	0,00	10,00	0,0
19	GOLDEN ORANGE / T337	11	5,80	3,40	240,00	12,10	0,00	10,00	0,0
20	INITIAL / M9	11	5,90	3,00	230,00	12,10	0,00	10,00	0,0
21	REBRA / M9	11	5,80	2,80	220,00	13,70	0,00	10,00	0,0
22	RUSTIC / M9	11	5,80	3,50	190,00	12,80	0,00	10,00	0,0
23	FLORINA / M9	12	5,90	3,50	225,00	14,05	0,00	10,00	0,0

Table 3. Behavior of 23 perspective apple varieties on the fireblight *Erwinia amylovora* attack RIFG Piteşti Romania, 2016-2018

Class	Very susceptible	Susceptible	Medium tolerant	Tolerant	'Resistant"
Attack intensity (notes)	**2--4**	**5**	**6--7**	**8--9**	**10**
Commercial varieties	Fuji, Granny Smith, Jonathan	Mutsu	Golden Delicious,Idared, Braeburn, Fuji Kiku Clona 8	Golden Lassa, Golden Reinders, Goldrush, MitchGala, Nured Jonathan, Prima	Florina, Golden Orange
Perspective varieties	Dalinco	Auriu de Bistriţa	Dalinbel, Jonaprince,Topaz	Romus 5, Ariwa, Dalinbel, Crimson Crisp, Dalinred, Dalinette, Enterprise, Hilwell	Aura, Bistriţean, Ciprian, Goldprim, Jonaprim, Starkprim, Iniţial, Rebra, Redix, Rustic, Romus 3, Romus 4, Ariane, Falstaff, Pinova
Rootstocks	M27, M26, M9, T337, Pajam 1	M106	-	-	-

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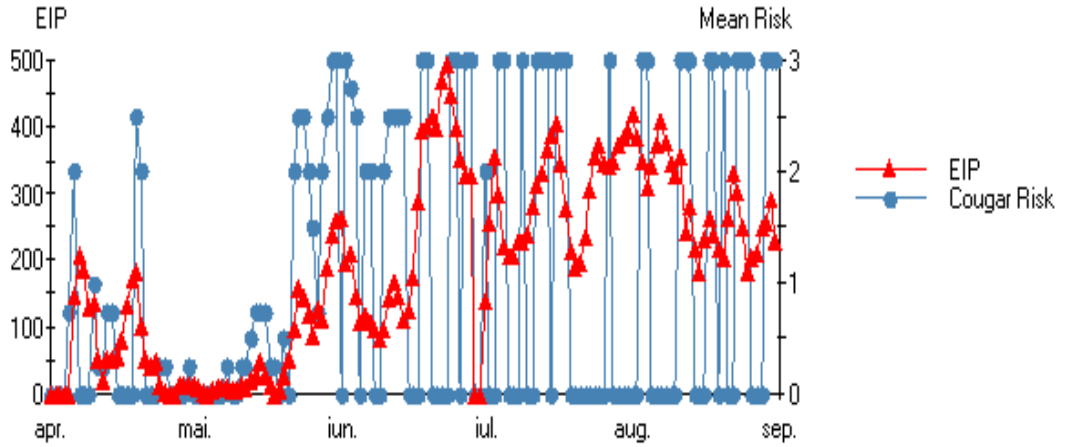

Fig. 1. Infection risk with *Erwinia amylovora* on apples, RIFG Piteşti Romania, *2016*

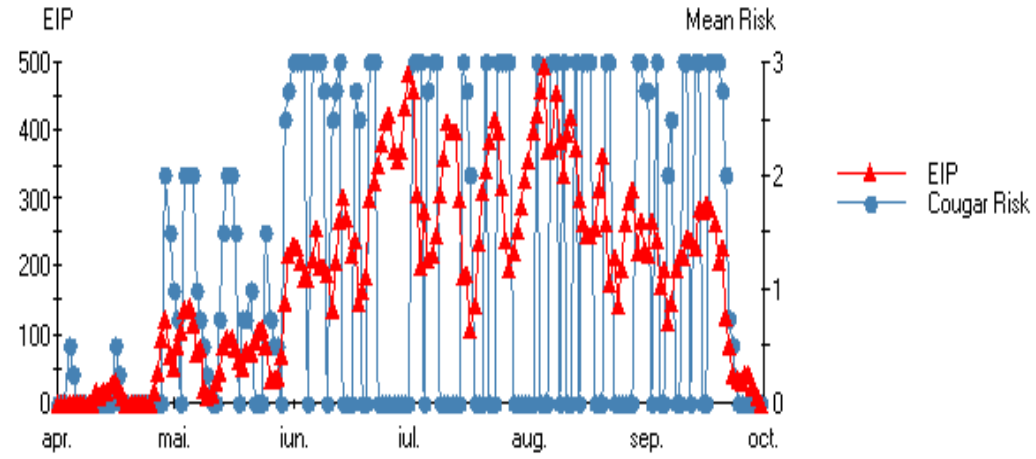

Fig. 2. Infections risk with *Erwinia amylovora* on apples, RIFG Piteşti Romania, *2017*

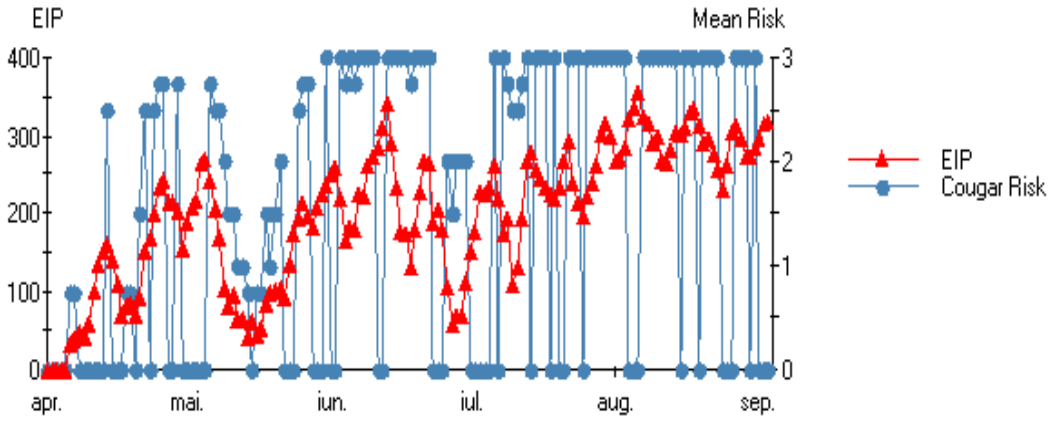

Fig. 3. Infections risk with *Erwinia amylovora* on apples, RIFG Piteşti Romania, *2018*

DOI 10.33045/fgr.v34.2018.18

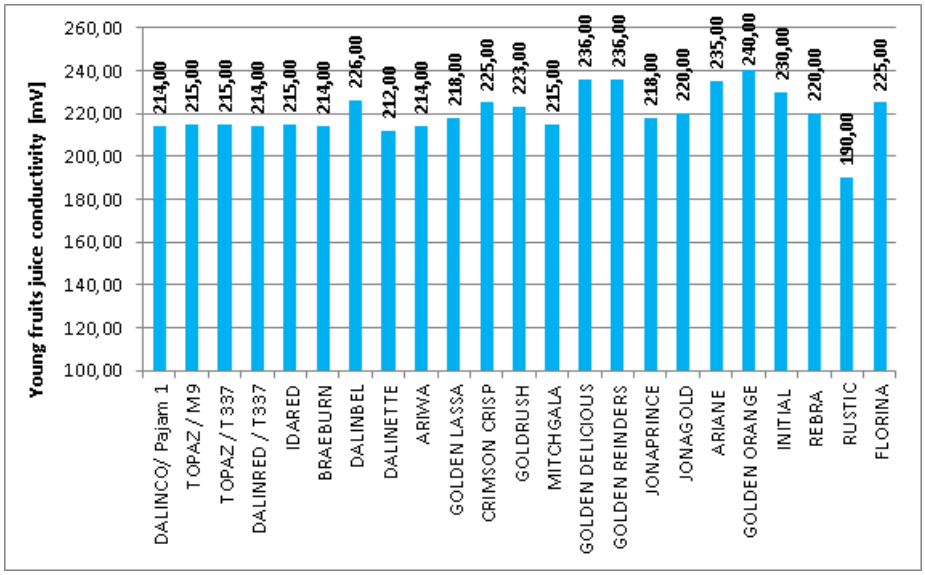

Fig. 4. Electric conductivity of the young fruits cell juice of 23 perspective apple varieties grown under superintensive system, RIFG Piteşti, Romania, 2016-2018

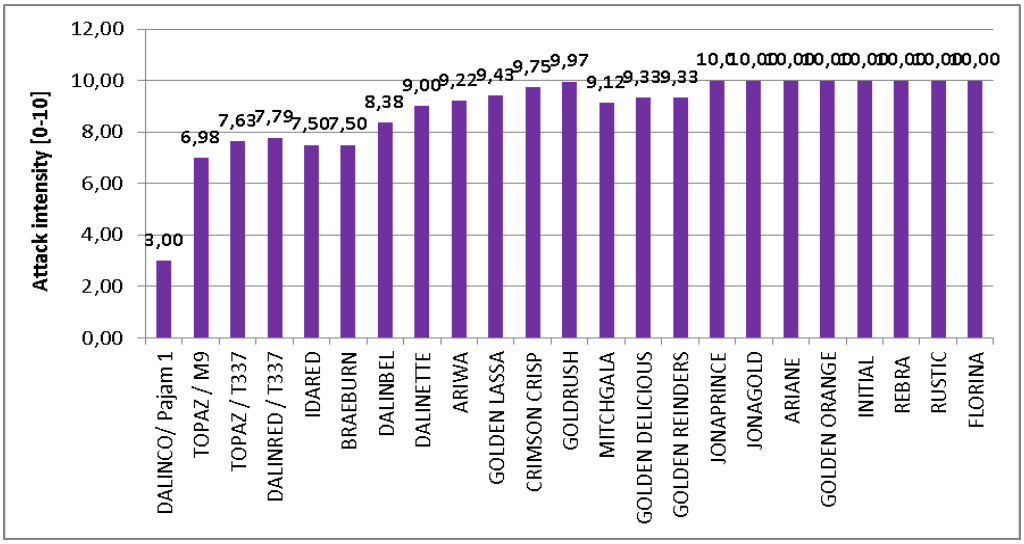

Fig. 5. Behavior of 23 perspective apple variety grown under superintensive system on the *Erwinia amylovora* attack intensity on lateral shoots, RIFG Piteşti Romania 2016-2018

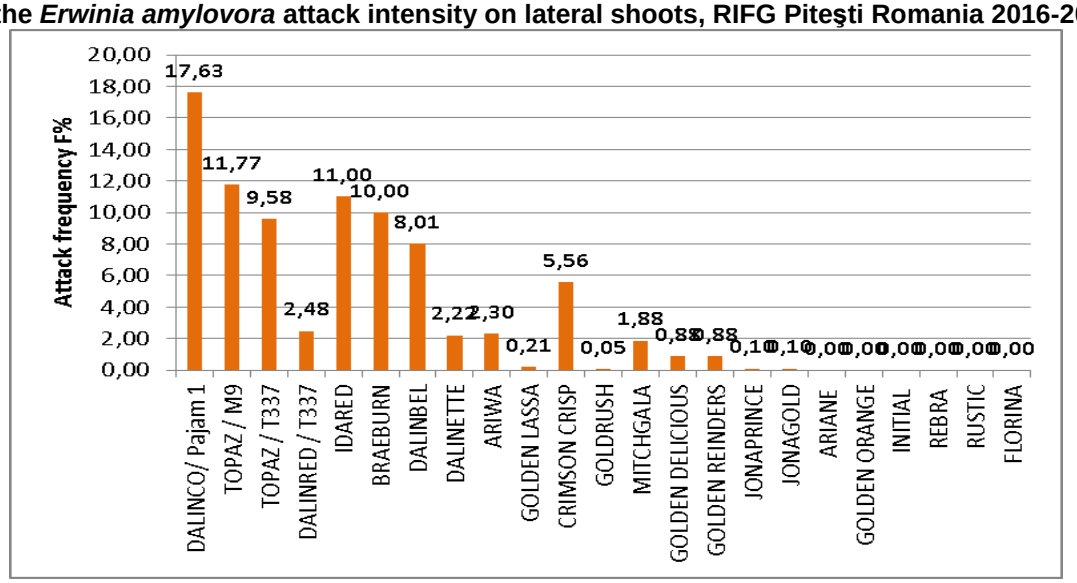

Fig. 6. Behavior of 23 perspective apple variety grown under superintensive system on the *Erwinia amylovora* attack frequency on lateral shoots, RIFG Piteşti Romania 2016-2018

DOI 10.33045/fgr.v34.2018.18

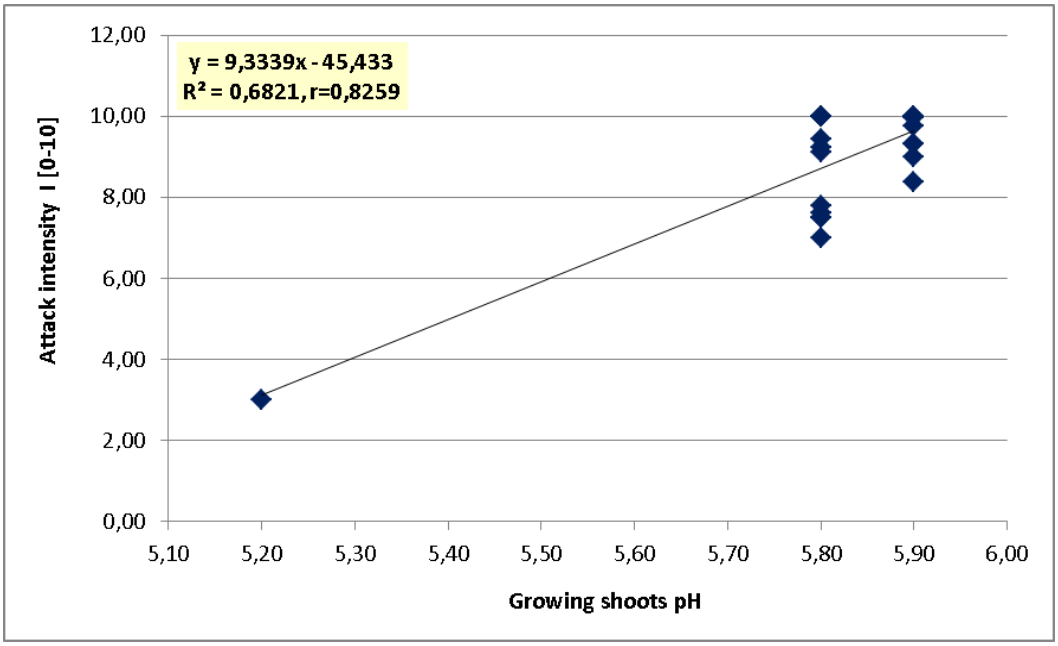

Fig. 7. Correlation between the growing shoots pH and fireblight attack intensity RIFG Piteşti Romania 2016-2018

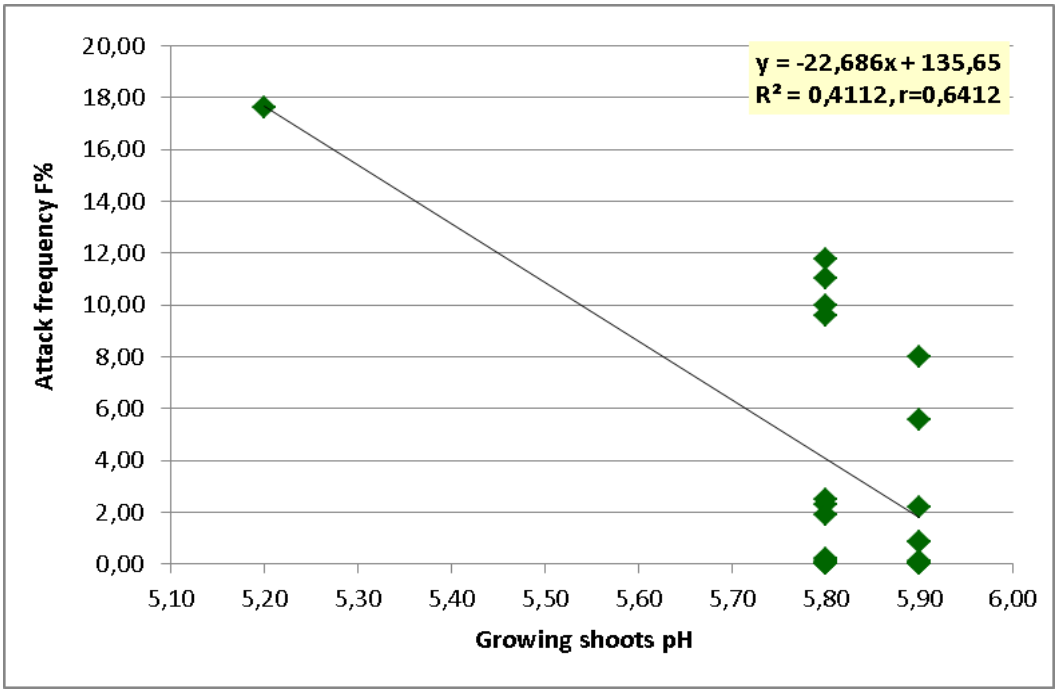

Fig. 8. Correlation between growing shoots pH and fireblight attack frequency RIFG Piteşti Romania 2016-2018

DOI 10.33045/fgr.v34.2018.18

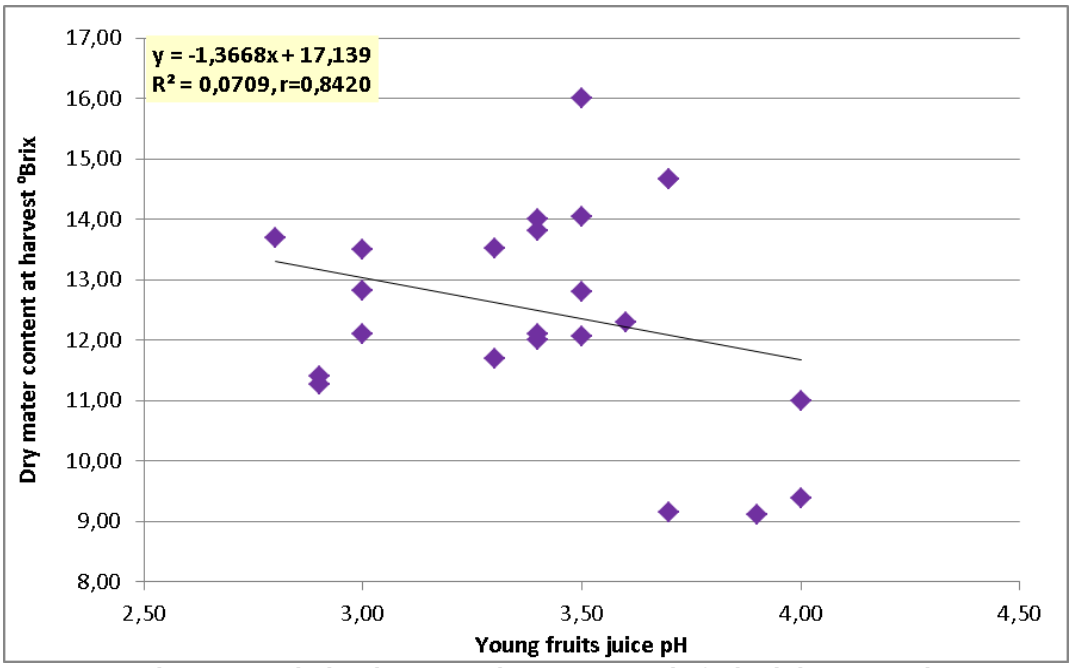

Fig. 9. Correlation between the young apple fruits juice pH and dry mater content of the fruits at the harvest time, RIFG Piteşti Romania 2016-2018

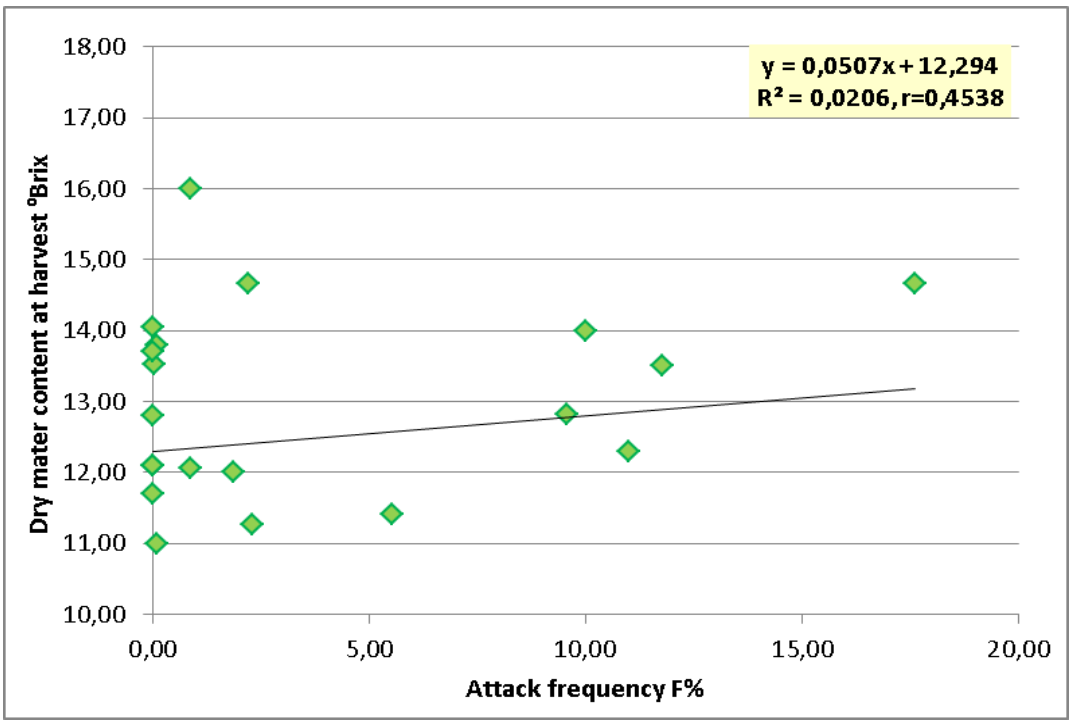

Fig. 10. Correlation between fireblight attack frequency and dry mater content of the fruits at the harvest time RIFG Piteşti Romania 2016-2018

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A.

B.

C.

Fig. 11. Firebligh *Erwinia amylovora* Burill Winslow attack on apple
A. on shoots; B. in the tree; C. on fruits