SENSIBILITATEA UNOR SOIURI DE PĂR LA ATACUL FOCULUI BACTERIAN (*ERWINIA AMYLOVORA*, BURILL)

FIRE BLIGHT SUSCEPTIBILITY OF SOME PEAR VARIETIES (*ERWINIA AMYLOVORA*, BURILL)

Zsolt Jakab- Ilyefalvi [1], Ioan Platon[1] , Angela Festila[1]
[1]Fruit Research and Development Station Bistriţa, Romania

Abstract

At Bistriţa Fruit Research and Development Station, in a pear collection, planted with 44 varieties, there has been studied the susceptibility to fire blight (*Erwinia amylovora,*Burill*).* During the vegetation period, phytosanitary treatments to control the disease have been applied using copper based products (copper sulfate, Champion, Funguran, Kocide). *Erwinia amylovora* infections have been influenced by the rainfall registered in April (70.9 mm) and May (104.7 mm) and the temperature fluctuations in April-May. The field observations on *Erwinia amylvora* attack demonstrate that the pear varieties have a different susceptibility to this dangerous bacterium. Evaluation of attack level in the pear collection was done using an evaluation scale with 9 scores using a reference resistance scale for : 'Highly resistant' , 'Moderately resistant', 'Susceptible', 'Very susceptible' cultivars . The most sensitive pear varieties in the collection were: 'De Noiembrie', 'Abatele Fetel', 'Daciana', 'Triumf', 'Williams Boway', 'Margareta Marillat', 'Beauty Tomme', 'Williams rosu', 'Aromata de Bistrita', 'Jeanne d`Arc', 'Aramiu de Somes', 'Belle des Arbres', 'Zorka' representing 13.64% of the total pear varieties. In several cultivars there have been observed increased symptoms, a very high susceptibility of infections leading to complete scorching of trees: Jeanne d`Arc', Williams rosu', 'Triumf', 'Aromata de Bistrita', 'Zorka'. Strong attack symtoms were observed at the pear cultivars 'Cure', 'Euras, 'Ciuda' 'Highland', 'Precoce Morettini', 'Monica', 'Cadillac', 'Juliana', 'Somesan', 'Beurré Hardenpont' these cultivars being susceptible to Erwinia amylovora , representing 40.91 % of total genotypes . Cultivars 'Untoasa Geoagiu', 'Beurre Hardy', 'Trivale' manifested a certain tolerance to *Erwinia amylovora ,* no attack symptoms being observable at these varieties, in 6,82 % of total studied cultivars scores ranged between 8.0-8.22. Notably amount of genotypes were included in the "Moderately resistant" category (34.04 %) 'Untoasa de Transilvania', 'Starkrimson', 'Josephine des Malignes', `Untoasa Bosc`, 'Magnes', 'Contesa de Paris', 'Doina', 'Napoca', 'Carpica', 'Karamanka', 'Williams', 'Expozitie', ' Ina Estival', 'Passe Crassagne', 'Conference'.

Keywords: *Pyrus communis,* infections, rainfall, tolerance, varieties, meteorological conditions
Cuvinte cheie: *Pyrus communis*,infecţie,precipitaţii atmosferice,soiuri,condiţii meteorologice

1. Introduction

Fire blight is a serious infectious disease caused by pathogen agent *Erwinia amylovora (*Burill, Winslow et al,1983*)* a Gram negative bacterium in the family Enterobacteriaceae (EPPO 2006) , one of the most damaging disease in the fruit growing world which generally infects Rosaceous plants, especially quince and pear. In Romania fire blight was first observed in 1992 in south east of the country; in Transylvania first notices are from 1993 , the infectious disease was considered to be different from one area to another but the symptoms were not so severe, to compromise orchards (Severin et al. 1999, Sestras A.,2008) . Fire blight breeding was undertaken in several fruit growing countries like USA, Czech Republic, France, Italy, Germany, Romania using resistant genotypes mainly *Pyrus pyrifolia* and *Pyrus ussuriensis*.

Climatic factors favor the appearance of the disease; it is considered to be a major factor in the epidemiology of the disease. Symptoms of fire blight are observable in spring on blossoms and succulent shoots. The affected blossoms become water scoarched and they are browning. The infected shoots, branches appear as well as being burnt by fire, torsioned, cracked. During spring wet weather, there is a high chance for *Erwinia amylovora* infection, climatic conditions having a major role through rainfall and dew resulting in small water droplets on leaves, blossoms which thus could contain millions of bacteria for the primary infection (Biggs et al., 2008). In early spring bacteria's are multiplying and the amber colored oozes containing millions of bacteria are transported by insects and are transferred to the flower stigmas. Bees

transfer the bacteria to additional flowers, bacteria develops on stigmas at 18.3 °C (Zoller et al.,1979). Rain washes bacteria to natural openings at flower base, infections occur, the flower cluster becomes blighted.

Through insects , rain, wounds, infections are rapidly propagated, bacteria are spread from blighted clusters to young growing shoots, secondary infections occurs within hours, thus repeated infections conduce to branches causing large area cancers, and from blighted shoots bacteria is moving systemically within the tree , susceptible rootstocks may be infected as well, bacteria over-winters in diseased tissues. Usually there are the main four stages of symptoms described, blossom blight, cancer blight, shoot blight, trauma blight, rootstock blight. Epidemics of plant disease results from the interaction between a population of susceptible host plants, a population of a pathogen and favorable weather conditions (Jones et al., 1992, Zoller et al., 1979). The symptoms can develop in an exponential manner, secondary infection symptoms can be worse than those in the primary infections. In the susceptible cultivars the amount of fire blight disease depends on: - the number and distribution of sources from which inoculum is available; - the genetic susceptibility of scion and rootstock cultivars; - the rate at which new infections occur. Direct connection is between the primary sources for fire blight, the amount of disease in the previous year and the phytosanitary procedures applied in the previous year and the actual year (Biggs et al., 2008).The aim of this work was to determine the level of resistance of several pear cultivars against *Erwinia amylovora* influenced by the special climatic condition present in this year (Figs 7-10).

2. Materials and methods

At Bistriţa Fruit Research and Development Station in a pear collection planted with 44 varieties there has been studied the susceptibility to fire blight (*Erwinia amylovora*) of the pear genotypes. The response of the studied genotypes was undertaken in natural conditions of infection (Figs 1-4). During the vegetation period phytosanitary treatments to control the disease have been applied using copper products (Copper sulfate, Champion, Funguran, Kocide). Calculated intensity of infection was assessed based on the USDA-ARS GRIN, IBPGR evaluation model (USDA, 2010b, Thibault et al. 1983), following a standardized disease phenotyping system (T. Van de Zveet et al. 1979). Each tree was included in an evaluation class according to the observed infection intensity and finally there was calculated the percentage of trees infected in each pear genotype and category (Tab.3-4).

3. Results and discussions

In the National Pear Collection, the fire blight attack was considered being very severe and intense, causing serious infections on vegetative tree elements, with differences depending on pear genotypes. Among pear cultivars there have been observed differences in the infection symptoms ranging from “Highly resistant” (without symptoms on leaves and branches) to “Very susceptible” class (trees are dried and senesced), being used an evaluation scale of 9 classes (Table 1). There have been studied 44 pear cultivars (*Pyrus communis*, L.) in a research plot with a completely randomized block design .

The intensity of the attack on the pear cultivars was considered as being high, affected genotypes percent ranged from 3.30 -8.22 % highly resistant to – very susceptible class range (Table 2). The majority of severe attacked and affected pear genotypes were in the moderately resistant (34.09%) and very susceptible categories (40.91%) (Tables 3-4). Although in 2012 special meteorological conditions existed for the development of fire blight symptoms, there were several cultivars which presented a very low or symptom-less phytosanitary status (scores ranging 8.00-8.22), genotypes were ’Untoasa de Geoagiu’,‘ Beurre Hardy’, ’Trivale’ (Table 3). Notably amount of genotypes were included in the “Moderately resistant” category (scores ranging 6,00-7,89) cultivars ‘Untoasa de Transilvania’, ‘Starkrimson’, ‘Josephine des Malignes’, ‘Untoasa Bosc’, ‘Magnes’, ‘Contesa de Paris’, ’Doina’, ‘Napoca’, ‘Carpica’, ‘Karamanka’, ‘Williams’, ’Expozitie’, ’Ina Estival’, ‘Passe Crassane’, ‘Conference’ being in this evaluation class (Table 3).

Susceptible cultivars to fire blight according our studies were: ‘Cure’, ‘Euras’, Ciudo’, ’Highland’, ’Precoce Morettini’, ’Monica’, ’Cadillac’, ’Juliana’, ‘ Somesan’, ‘Beurré Hardenpont’ evaluation scores ranged from 5.00 to 5.82.

Very strong attack symptoms were observed at cultivars ‘De Noiembrie’, ‘Abatele Fetel’, ’Daciana’, ’Triumf’, ’Williams Boway’, ‘Margareta Marillat’, ‘Beauty Tome’, ‘Williams rosu’, ‘Aromata de Bistrita’, ‘Jeanne d` Arc’, ‘Aramiu de Somes’, ’Belle des Arbres’, ‘Zorka’ scores ranging from 3.30 to 4.86.

In several cultivars there have been observed increased symptoms, a very high susceptibility of infections leading to complete scorching of trees: ‘Jeanne d`Arc’, Williams rosu’, ‘Triumf’, ‘Aromata de Bistrita’, ‘Zorka’. The results obtained confirms that the majority of western *P. communis* pear cultivars are susceptible to fire blight disease (*Erwinia amylovora*) according to the scientific literature (Van der

Zwet,1990), however in several cases there is observed a different response to fire blight. It is the case of cultivars 'Williams' , 'Conference', 'Passe Crassane' considered susceptible in our studies were included in the "moderately resistant" class, however cultivar 'Magnes' was correctly included in the "very low attack" class according to specific literature (Sestras et al., 2008). Interestingly the moderately resistant-susceptible cultivars 'Untoasa de Geoagiu' and 'Beurre Hardy' in this years presented very low fire blight symptoms. In the multianual studies of Van der Veet and colabs. (1990) there were compared 86 Romanian cultivars with cultivars from Yugoslawia, Poland, Hungary, Czehoslovakia, results showed that cultivars 'Aromata de Bistrita', 'Untoasa de Geoagiu', 'Napoca', were included in the 1-5 score class according to our studies and Aniversare in the 6-7 scoring class among other cultivars. The Yugoslavian cultivar 'Karamanka' (score 6.5) was included in the Score 10 class, in our studies was included in the moderately resistant class (6-7). 'Magnes' cultivar was included by several authors in the Moderately resistant class confirmed also by our studies (7,00) .

According to European pear varieties AG Facts publication (Campbell, 2002) there are considered as susceptible the varieties 'Beurre Bosc', 'Conference', 'Williams', 'Abate Fetel', 'Beurre Hardy', 'Clap's Favorite', 'Passe Crassane' which confirmed partially our studies. The moderately susceptible cultivar 'Precoce Morettini' in our studies in several trees presented a complete scorching of trees in 2012.

4. Conclusions

1. The response of pear genotypes to the susceptibility of fire blight infections (*Erwinia amylovora*) in the 44 studied cultivars had a large variability, main influencing factor in the development of the disease was the genotype and the meteorological conditions which favored the appearance of the fire blight infections.
2. In several cultivars there have been observed increased symptoms, a very high susceptibility of infections leading to complete scorching of trees.
3. The most sensitive pear varieties with very strong symptoms in the collection were: 'De Noiembrie', 'Abatele Fetel', 'Daciana', 'Triumf', 'Williams Boway', 'Margareta Marillat', 'Beauty Tome', 'Williams rosu', 'Aromata de Bistrita', 'Jeanne d` Arc', 'Aramiu de Somes', 'Belle des Arbres', 'Zorka', representing 13.64% of the total pear varieties.
4. A strong attack of 40.91 % of the total genotypes were observed at the pear cultivars 'Cure', 'Euras, 'Ciudo' 'Highland', 'Precoce Morettini', 'Monica',' Cadillac', 'Juliana', 'Somesan', 'Beurré Hardenpont' these cultivars being susceptible to *Erwinia amylovora*.
5. 'Untoasa de Geoagiu', 'Beurre Hardy', 'Trivale' cultivars manifested a certain tolerance to *Erwinia amylovora, n*o attack symptoms being observable at these varieties (6.89 %) in 2012.
6. The obtained results are preliminary and the test will continue in future.
7. The cultivars with no attack and low attack degree could be used in further studies in order to choose potential sources for pear breeding program.

5. Refrences

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Tables and figures

Tab.1. Fire blight resistance classes according the percent blighted scores

Class	Resistance class	Score	Percent blighted (%)
1	Highly resistant	10-8	0-6 %
2	Moderately resistant	7-6	7-25 %
3	Susceptible	5	26-50 %
4	Very susceptible	4-1	51-100 %

Tab. 2. Fire blight scoring system for the evaluation of blight resistance in pear (Van der Zweet et al,1979)

Resistance class	Score	Percent blighted (%)
Highly resistant	9	1-3 %
	8	4-6 %
Moderatly resistant	7	7-12 %
	6	13-25 %
Susceptible	5	26-50 %
Very susceptible	4	51-75 %
	3	76-88 %
	2	89-99 %
	1	100 %

Fig. 1. Generalized fire blight infection on primary branches (score 3)

Fig. 2. Fire blight infections on branches and vegetative elements (score 2)

Fig. 3. Very intense infection of fire blight on shoots, branches (score 2)

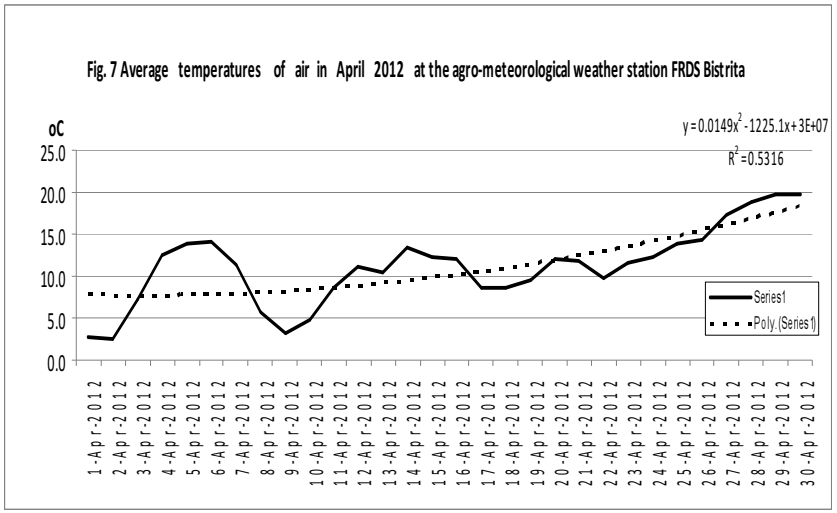
Fig. 4. Fire blight infections on fruits

Table 3. The fireblight attack on different pear genotypes according to different infection class (% of trees affected by *Erwinia amylovora* / genotype)

No. crt	Genotypes							
	Highly resistant (10-8)	***Score average***	**Moderately resistant (7-6)**	***Score average***	**Susceptible (5)**	***Score average***	**Very susceptible (4-1)**	***Score average***
1	Untoasa Geoagiu	8,22	Untoasa de Transilvania	7,89	Cure	5,82	De Noiembrie	4,86
2	Beurre Hardy	8,0	Starkrimson	7,88	Euras	5,80	Abatele Fetel	4,80
3	Trivale	8,0	Josephine des Malignes	7,67	Ciuda	5,78	Daciana	4,67
4			Untoasa Bosc	7,30	Highland	5,75	Triumf	4,60
5			Magnes	7,00	Precoce Morettini	5,67	Williams Boway	4,50
6			Contesa de Paris	6,97	Monica	5,61	Margareta Marillat	4,50
7			Doina	6,83	Cadillac	5,50	Beauty Tomme	4,50
8			Napoca	6,71	Juliana	5,44	Williams rosu	4,33
9			Carpica	6,56	Somesan	5,30	Aromata de Bistrita	3,90
10			Karamanka	6,50	Beurre Hardenpont	5,00	Jeanne d` Arc	3,89
11			Williams	6,39			Aramiu de Somes	3,40
12			Expozitie	6,38			Belle des Arbres	3,38
13			Ina Estival	6,12			Zorka	3,30
14			Passe Crassane	6,00				
15			Conference	6,00				

Table 4. Fire blight resistance class results in the National Pear Collection in 2012

Class	Resistance class	Score	Percent blighted cultivars from total (%)
1	Highly resistant	10-8	6,82
2	Moderately resistant	7-6	34,04
3	Susceptible	5	40,91
4	Very susceptible	4-1	13,64



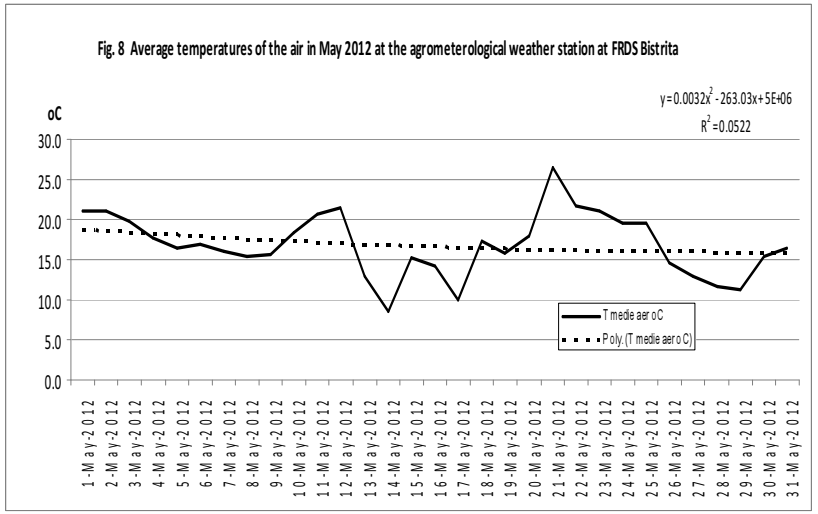
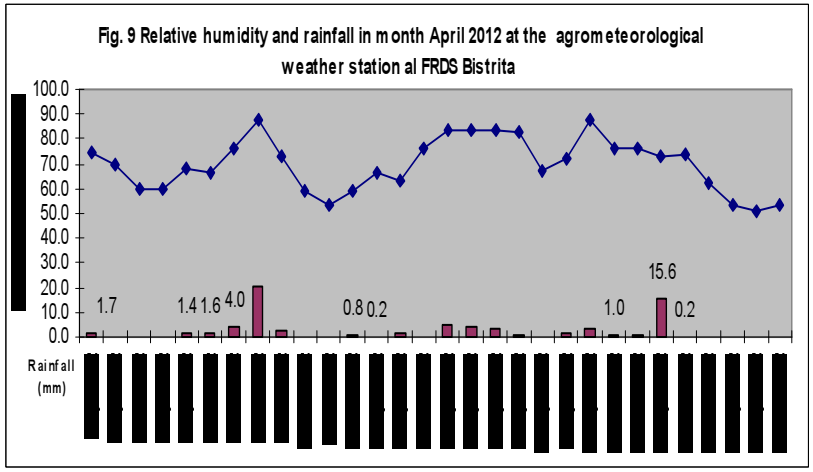


Fig 7-8 Average temperatures of air in months April, May 2012 at the agro-meteorological weather station al F.R.D.S. Bistrita



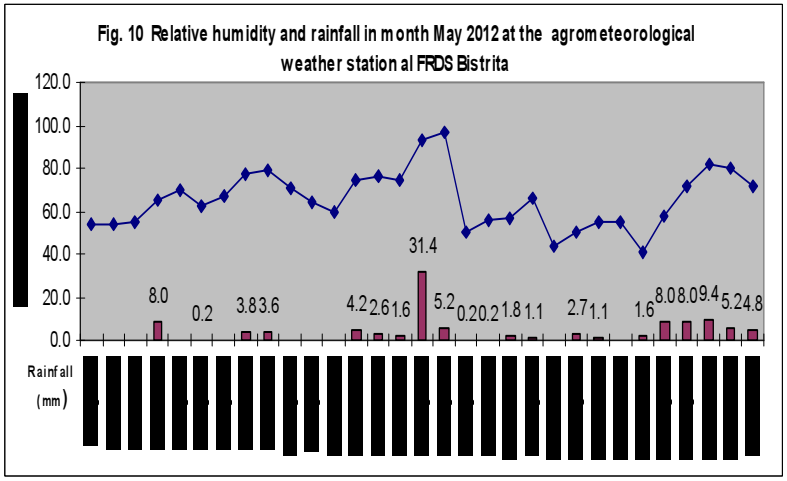


Fig 9-10 Relative humidity and rainfall in months May, June 2012 at the agro-meteorological weather station al F.R.D.S. Bistrita

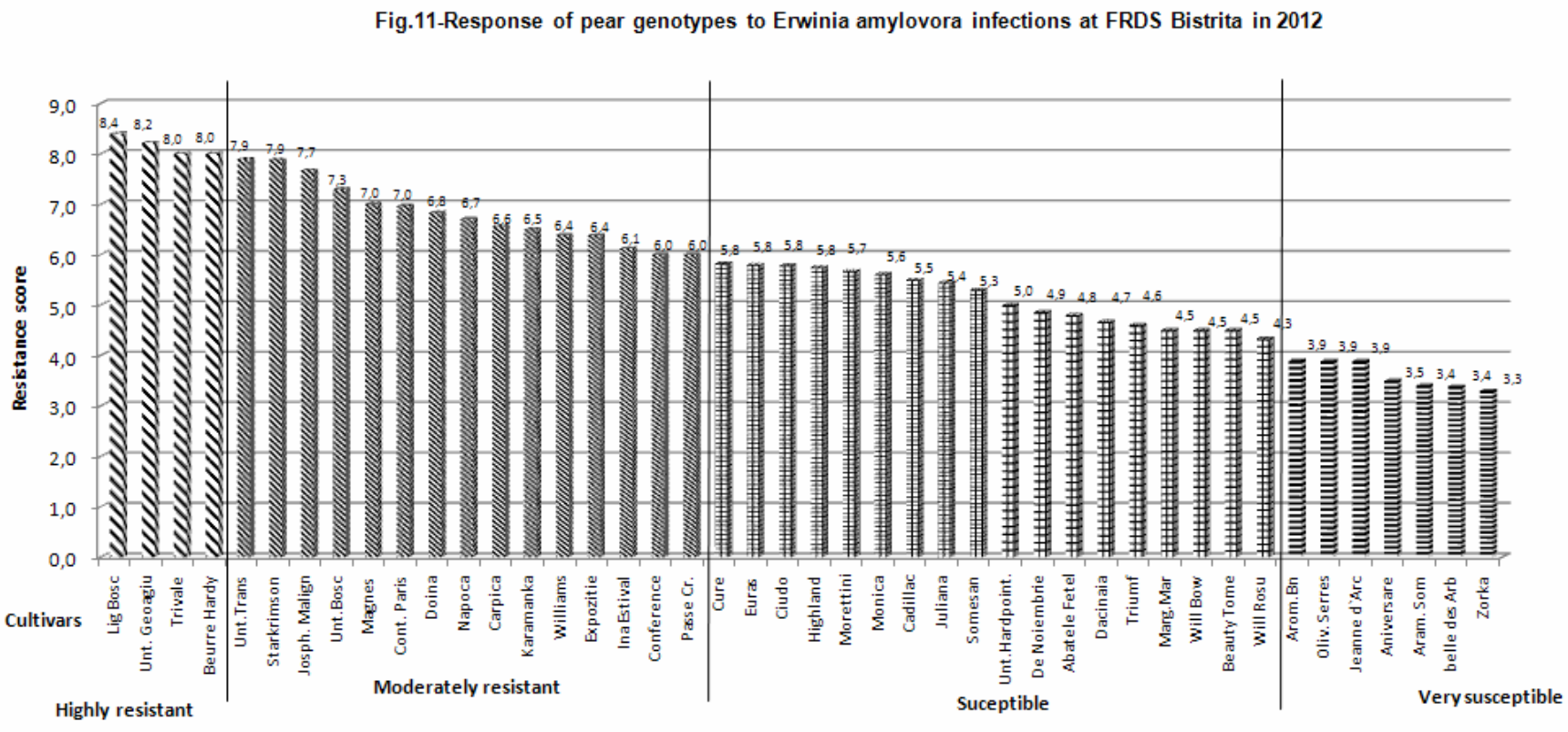


Fig.11 – Response of pear genotypes to *Erwinia amylovora* infections at FRDS Bistrita in 2012