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RESEARCH REGARDING APPLE VARIETIES RESISTANCE TO DISEASE - BASIC COMPONENT OF ECOLOGICAL POMICULTURE

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Abstract: The research presented here, were made during 2003-2004 in the Pomicultural Research Station of Bistrița and its primary objective was to study the behavior of 47 apple varieties, Romanian and foreign, to the apples scab (*Venturia inaequalis*), powdery mildew (*Podosphaera leucotricha*), black rot (*Monilia fructigena*), and the bacterial fire of rosaceae (*Erwinia amylovora*) invasion.

In the year of 2003 in Bistrița the meteorological conditions were advantageous for all these pathogenic agents to evolve and in 2004 were very advantageous.

In the experimental plot there were applied the minimum phytosanitary treatments (four in 2003, five in 2004) from which mandatory were the prefloral ones with fungicides. Post floral were applied 1-2 treatments with systemic fungicides. Observing the 47 apple varieties the most resistant ones were: ‘Quinte 208’, ‘Champion’, ‘Zvoncove’, ‘Haralson’, ‘Oldenburg’, ‘Ancuța’, ‘Empire’, ‘Macspur’, ‘Ardelean’, ‘Discovery’, ‘Red Well’, ‘Carola’, ‘July Red’, ‘Mantet’, ‘Belren’, ‘Mc Intosh’, ‘Jonamac’, ‘Liberty’, ‘Monroe’, ‘Blaxtayman’, ‘Anka’, ‘Akane’, ‘Cortland’, ‘Rambo’, ‘Lobo’, ‘Goldspur’, ‘Yellow Newton’ at the **apple scab** (*V. inaequalis*); ‘Haralson’, ‘Winesap’, ‘Triple Red’, ‘Blaxtayman’, ‘Rambo’, ‘Lord Lambourne’, ‘Starkrimson’, ‘July Red’, ‘Penstayman’ at the **powdery mildew** (*P. leucotricha*). To black rot (*M. fructigena*) the majority of the 47 varieties with the exception of 5 breeds (‘Lobo’, ‘Monroe’, ‘Akane’, ‘Cortland’, ‘Rome Beauty’) were proved to be resistant at this mycose. For **the bacterial fire of rosaceae** (*E. amylovora*) the most attacks were registered in case of ‘Jonathan’, ‘Idared’ and ‘James Grieve’ varieties.

Keywords: apple, ecology pomiculture, resistance of varieties, apple scab, powdery mildew, black rot, frequency of attack, intensity of attack, degree of attack, fungicides.

Introduction

Disease resistance of various varieties is a basic component of organic agriculture. Growth of resistant varieties allows on one side important economical accomplishments due to the reduced number of sprays and on the other side it protects the environment and the consumers. The organic system of culture plants cultivation develops the most suited local resources for the maintaince of the ecological balance and development of the biological processes in optimum limits [11]. These systems consider the soils fertility as the success key in the accomplishment of these productions. In this type of agriculture all natural resources, which can conduct to quantitative and qualitative productions, are used: pollenisators, plunders, natural parasites of the pests, soil microorganisms, etc. [8, 13]. In organic agriculture excluding the chemical fertilizers and pesticides drastically reduces the inputs. On the other side, the ecological agricultural system reduces the natural process in an agro-system by production growth and plant resistance at parasites [9, 10].

The great biodiversity represents a big advantage for organic agriculture where the preservation and use of local population is encouraged [3, 12]. In case of *Malus domestica* Borkh 10.000 cultivated varieties were estimated [4]. Paradoxically, on large areas a small number of varieties are grown. The disease and pest resistance of varieties represent an important component of ecological agriculture [5, 6, 7]. This allows, on one side, important economical

accomplishments due to the small number of spays and on the other side, protects the environment and the consumers.

Research regarding the resistance to *Venturia inaequalis*, one of the most dangerous apple diseases was done from the beginning of the 20th century. In 1897, Aderhold studied the apple scab sensibility for 106 varieties, showing the absence of total immunity. Later between 1934-1935 Rudolf and Schmidt showed that *Malus atropurpurea*, *M. micromalus*, *M. spectabilis* and *M. kaido* varieties present an appreciable resistance to apple scab.

Also, Schmidt obtained descendence from the Antonovka variety, some of the descendents were resistant, but way this resistance is transmitted was proved to be very complex. In 1994, Hough in USA embossed some 1082 clone shootss resistance from *Malus floribunda* opening new perspectives for the amendament program to obtain commercial varieties with genetic resistance to apple scab.

Other apple varieties with simple heredity were used as resistance genitors: *Malus micromalus*, *M. prunifolia*, *M. prunifolia microcarpa*, *M. prunifolia xanthocarpa* and *M. baccata*.

Parallel, other resistance sources with polygenic heredity were found, with horizontal type like: *Malus baccata* (some shoots), *M. sargentii*, *M. sieboldii*, *M. toringo* and *M. zumi calocarpa*.

In case of powdery mildew (*Podosphaera leucotricha* -Ell, et Ev - Salm) observations were done in England in a collection of 2140 varieties that showed that none of them were immune to powdery mildew. Nonetheless, 112 varieties presented a good resistance to this fungus. These were used for crossings showing that some of them transmit in descendence a level of transmission equal or bigger than them. This resistance or this low sensibility it's determined by more minor genes.

In this varieties 2 clones came from *Malus robusta* and *M. zumi*, which present resistance. From the hybridization made with these 2 clones, total resistant to powdery mildew hybrids were obtained, and with bigger fruit than the ones from the initial plants. Other sources of resistance to powder mildew offer *Malus floribunda microcarpa* and *M. kinoensis*. In our country for this resistance *Malus kaido* and *M. zumi* were studied and they transmitted this characteristic as dominant in their descendence [2].

A complete resistance to bacterial fire blight (*Erwinia amylovora* – Burrill – Winslow et al.) was discovered at the wild varieties with small fruits *Malus fusca*, *M. prunifolia*, *M. sieboldii*, *M. robusta* 5, *M. sublobata*. The resistance of the last two varieties is with an oligogenic control, each having 2–3 genes of resistance [10].

Materials and Working Methods

Research was done during 2003-2004, in Pomicultural Research Station (SCPP) Bistrița and had the principal objective to study the behavior of 47, romanian and foreign, apple tree varieties, to the apple scab (*Venturia inaequalis*), the powdery mildew (*Podosphaera leucotricha*), black rot (*Monilia fructigena*) and bacterial fire blight (*Erwinia amylovora*) attack, in order to utilize this in the ecological system of apple trees. The varieties studied were: 'Quinte 208', 'Lody', 'Kidd s Orange', 'Roșu of Cluj', 'Virginia Gold', 'Champion', 'Zvoncove', 'Jonagold', 'Penstayman', 'Melrose', 'Gloster', 'Rome Beauty', 'Matcino', 'Haralson', 'Vista Bella', 'Winesap', 'Oldenburg', 'Ancuța', 'Empire', 'Mac spur', 'Ardelean', 'Discovery', 'Red Well', 'Carola', 'Triple Red', 'Goldspur', 'July Red', 'Mantet', 'Belren', 'Yellow Newton', 'Mc Intosh', 'Florina', 'Jonamac', 'Lobo', 'Liberty, Monroe', 'Blaxtayan', 'Anoka', 'Rambo', 'Lord Lambourne', 'Akane', 'Cortland', 'Auriu of Bistrița', 'Generos', 'Jonathan', 'Starkrimson', 'Golden delicious'.

The agro meteorological data were registered with the computerized system AgroExpert which contained temperature, rain-fall and relative humidity of the air and leaf rain drops sensors.

The resistance evaluation for these varieties was done by direct observations in the orchard in the second half of September. For appreciating the varieties behavior to apple scab, powdery mildew, black rot and bacterial fire frequency, attack intensity and attack degree were calculated. For the frequency calculation, the following formula was applied:

$F\% = n \times 100/N$ (n = number of plants or organs attacked, N = number of studied plants and organs).

For the intensity attack calculation a six class notation system was used. According to this relation $I = \sum (i \times f) / n$ (I = attack coverage percent, f = number of cases with each mark attack,

n = total number of attack cases). The degree of attack (DA %) is the expression of the development of serious attack upon the culture or number of observed plants). The value expression of DA is given by the formula: $DA\% = F \times I / 100$.

In the experimental area a minimum of phytosanitary treatments were applied (4 in 2003, 5 in 2004), and the mandatory ones were the prefloral with contact fungicides (Bordeaux mixture 0.5%). Post floral was applied 1-2 treatments with system fungicides (Stroby DF 0.015%, Shavit 71.5 – 0.2%).

Results

In 2003 at Bistrița the meteorological conditions were favorable for the evolution of all studied pathogenic agents, and in 2004 were very favorable.

In table 1, information is presented regarding the apple scab attack in the variety collection of SCDP Bistrita, during 2003-2004. In 2003 the attack of this micosis was generally reduced from the 47 studied varieties, no attack was registered on leaves and fruits on the following varieties: 'Quinte 208', 'Lady, Kidd's', 'Orange', 'Roșu of Cluj', 'Virginia Gold', 'Champion', 'Jonagold', 'Zvoncove', 'Melrose', 'Gloster', 'Haralson', 'Matcino', 'Vista Bella', 'Oldenburg', 'Ancuța', 'Empire', 'Mac Spur', 'Ardelean', 'Red Well', 'Carola', 'July Red', 'Mantet', 'Belren', 'Florina', 'Liberty', 'Lord Lambourne', 'Auriu of Bistrița', 'Generos'.

In the conditions of weak apple scab infections in 2003, the greater attacks were on: leaves – 'Monroe' (DA = 1,8 %), 'Golden delicious' (DA = 1,7%), 'Starkrimson' (DA = 1,4%); on fruits – 'McIntosh' (DA = 0,2%).

In 2004 the conditions for apple scab infections were more favorable and permitted the resumption of various resistances of these diseases.

So the total number with zero attack of apple scab is more reduced compared to 2003. From the 47 studied varieties, 8,5% of them presented apple scab attack ('Lady', 'Discovery', 'Florina', 'Lyberty').

The most resistant were proved to be 'Quinte 208' (sporadically), 'Champion' (sporadically), 'Lord Lambourne' (sporadically), 'Melrose' (DA = 0,06 %), 'Haralson' (DA = 0,06%), 'Matcino' (DA = 0,06%), 'Blaxtayman' (DA = 0,06%), 'Carola' (DA = 0,09%).

The most resistant to apple scab attack proved to be: 'Quinte', 'Champion', 'Zvoncove', 'Haralson', 'Oldenburg', 'Ancuța', 'Empire', 'Mac Spur', 'Ardelean', 'Discovery', 'Red Well', 'Carola', 'July Red', 'Mantet', 'Belren', 'McIntosh', 'Jonathan', 'Liberty', 'Monroe', 'Blaxtayman', 'Anoka', 'Alkane', 'Corthland' (DA = 0%), 'Rambo' (DA = 0,03%), 'Lobo' (DA = 0,06%), 'Goldspur' (DA = 0,06%), 'Yellow Newton' (DA = 0,09%). At these we can add the four varieties from the first category (zero attack on leaves and fruits).

The most important apple scab attack was registered on the following varieties: ‘Yellow Newton’ (on leaves DA = 2,6% and on fruits 0,09%), ‘Triple Red’ (on leaves DA = 2,5% and on fruits 2,1%), ‘Goldspur’ (on leaves DA = 1,2% and on fruits sporadically), ‘Kidd’s Orange’ (on leaves DA = 1,7% and on fruits sporadically), ‘Rome Beauty’ (on leaves DA = 2,2% and on fruits sporadically).

Table 1: The behaviour of different apple varieties to the apple scab attack (*V. inaequalis*) during 2003-2004, in Bistrița conditions

Variety	Degree of attack (DA %)		Degree of attack (DA %)	
	Leaves	Fruits	Leaves	Fruits
Quinte 208	0	0	Sporadically	0
Lody	0	0	0	0
Kidd s Orange	0	0	1,7	Sporadically
Roșu de Cluj	0	0	0,2	0,9
Virginia Gold	0	0	0,6	Sporadically
Champion	0	0	Sporadically	0
Zvoncove	0	0	1,2	Sporadically
Jonagold	0	0	0,4	0
Penstayman	0,15	0,03	0,3	Sporadically
Melrose	0	0	0,06	Sporadically
Gloster	0	0	0,8	0,3
Rome Beauty	0,3	Sporadically	2,2	Sporadically
Matcino	0	0	0,06	0
Haralson	0	0	0,06	Sporadically
Vista Bella	0	0	0,9	Sporadically
Winesap	Sporadically	Sporadically	0,8	0,1
Oldenburg	0	0	0,1	0
Ancuța	0	0	0,2	0
Empire	0	0	0,4	0
Mac spur	0	0	0,3	0
Ardelean	0	0	0,3	0
Discovery	Sporadically	0	0	0
Red Well	0	0	0,5	0
Carola	0	0	0,09	0
Triple Red	0,2	0,1	2,5	2,1
Goldspur	Sporadically	Sporadically	2,4	0,06
July Red	0	0	0,2	0
Mantet	0	0	0,5	0
Belren	0	0	0,1	0
Yellow Newton	Sporadically	0	2,6	0,09
Mc Intosh	0,1	0,4	0,9	0,4
Florina	0	0	0	0
Jonamac	Sporadically	0	0,2	0
Lobo	Sporadically	0	0,3	0,06
Liberty	0	0	0	0
Monroe	1,8	0,2	0,2	0
Blaxtayman	0,2	Sporadically	0,06	0
Anoka	0,03	0	0,2	0
Rambo	0,1	Sporadically	0,2	0,03
Lord Lambourne	0	0	Sporadically	Sporadically
Akane	0,2	0	0,4	0
Cortland	0,4	0,03	0,6	0
Auriu de Bistrița	0	0	0,5	Sporadically
Generos	0	0	0,4	Sporadically
Jonathan	Sporadically	0	0,9	0,3
Starkrimson	1,4	Sporadically	5,0	7,3
Golden delicious	1,7	0	1,2	0,9

The powdery mildew attack on the apple trees collections from Bistrița was powerful comparative to the apple scab, in 2003 - table 2.

Table 2: The behaviour of different apple varieties to the powdery mildew attack (*Podosphaera leucotricha*) during 2003-2004, in Bistrița conditions

Variety	Degree of attack (DA %)		Degree of attack (DA %)	
	Leaves	Shoots	Leaves	Shoots
Quinte 208	0	0	4,0	9,0
Lody	Sporadically	0	0,9	2,6
Kidd's Orange	Sporadically	Sporadically	0,9	3,0
Roșu de Cluj	12,3	21,5	15,2	43,7
Virginia Gold	11,5	20,5	52,0	36,5
Champion	0,5	Sporadically	3,7	2,3
Jonagold	0,5	Sporadically	12,5	20,3
Zvoncove	1,8	3,0	6,0	13,0
Penstayman	0,5	1,5	0,7	1,6
Melrose	0,8	1,5	8,9	14,7
Gloster	0	0	0,1	3,5
Rome Beauty	0,5	2,5	32,9	51,0
Haralson	Sporadically	Sporadically	Sporadically	0,9
Matcino	Sporadically	Sporadically	8,4	14,2
Vista Bella	0,8	3,3	3,9	9,2
Winesap	Sporadically	Sporadically	0	0
Oldenburg	Sporadically	Sporadically	0,8	2,2
Ancuța	Sporadically	Sporadically	4,6	1,5
Empire	11,5	46,5	34,0	80,0
Mac spur	Sporadically	Sporadically	Sporadically	1,5
Ardelean	14,0	52,7	5,5	15,7
Discovery	Sporadically	Sporadically	3,5	2,2
Red Well	Sporadically	Sporadically	Sporadically	0,5
Carola	Sporadically	1,8	31,0	47,6
Triple Red	Sporadically	0	0	0
Goldspur	0,8	2,3	6,4	5,7
July Red	Sporadically	0	0,9	0,2
Mantet	14,0	37,5	32,0	58,9
Belren	0,8	2,7	0,4	12,3
Yellow Newton	Sporadically	0	3,5	8,2
Mc Intosh	1,8	3,5	16,9	18,5
Florina	Sporadically	Sporadically	3,1	12,9
Jonamac	12,2	28,5	7,6	19,7
Lobo	9,7	26,5	12,5	27,6
Liberty	1,0	Sporadically	3,1	6,5
Monroe	12,2	31,7	41,2	53,5
Blaxtayan	0,8	3,5	Sporadically	0,7
Anka	Sporadically	1,8	7,2	20,2
Rambo	Sporadically	0	Sporadically	0,5
Lord Lambourne	Sporadically	2,0	Sporadically	0,6
Akane	0,2	9,0	Sporadically	1,7
Cortland	Sporadically	0,8	1,8	5,1
Auriu de Bistrița	1,8	4,0	3,5	7,2
Generos	1,8	4,9	2,6	4,2
Jonathan	16,5	29,9	42,5	53,4
Starkrimson	Sporadically	Sporadically	Sporadically	0
Golden delicious	0,03	Sporadically	6,3	7,4

On 'Quinte 208' and 'Gloster' no attack was observed. Very reduced attacks of *Podosphaera leucotricha* were observed on the following: 'Lody', 'Triple Red', 'July Red', 'Yellow Newton', 'Rambo' (on leaves sporadically and on shoots zero), 'Kidds Orange', 'Haralson', 'Matcino', 'Winesap', 'Oldenburg', 'Ancuța', 'Macspur', 'Discovery', 'Red Well', 'Florina', 'Starkrimson' (leaves and shoots sporadically), 'Champion' (leaves = 0,5% and shoots = sporadically), 'Jonagold' (leaves = 0,5% and shoots = sporadically), 'Cortland' (leaves = sporadically and shoots = 0,8%), 'Golden delicious' (leaves = 0,03% and shoots = sporadically).

The greatest attack of powdery mildew was in 2003 on the following apple varieties descendent: 'Ardelean' (leaves = 14%, shoots = 52,7%), 'Empire' (leaves = 11,5%, shoots = 46,5%), 'Mantet' (leaves = 14%, shoots = 37,5%), 'Monroe' (leaves = 12,2%, shoots = 31,7%), 'Jonathan' (leaves = 16,5%, shoots = 29,9%), 'Jonamac' (leaves = 12,2%, shoots = 28,5%), 'Lobo' (leaves = 9,7%, shoots = 26,5%), 'Roșu de Cluj' (leaves = 12,3%, shoots = 21,5%), 'Virginia Gold' (leaves = 11,5%, shoots = 20,5%).

In 2004, no powdery mildew attack was registered on Winesap and Triple Red and to the following varieties attack were reduced: 'Haralson' (leaves = sporadically, shoots = 0,9%), 'Red Well' (leaves = sporadically, shoots = 0,5%), 'Blaxtayman' (leaves = sporadically, shoots = 0,7%), 'Rambo' (leaves = sporadically, shoots = 0,5%), 'Lord Lambourne' (leaves = sporadically, shoots = 0,6%), 'Starkrimson' (leaves = sporadically, shoots = 0%), 'July Red' (leaves = 0,9%, shoots = 0,2%), 'Penstayman' (leaves = 0,7%, shoots = 1,6%).

The most sensitive to the powdery mildew attack proved to be the following varieties: 'Empire' (leaves = 3,4%, shoots = 80%), 'Mantet' (leaves = 32%, shoots = 58,9%), 'Monroe' (leaves = 41,2%, shoots = 53,5%), 'Jonathan' (leaves = 42,5%, shoots = 53,4%), 'Rome Beauty' (leaves = 32,9%, shoots = 51%), 'Carola' (leaves = 31%, shoots = 47,6%), 'Roșu de Cluj' (leaves = 15,2%, shoots = 43,7%).

In 2003, the majority of the studied apple varieties didn't registered black rot attack on leaves. The next four varieties presented fruits attacked by *Monilia fructigena*: 'Lobo' (frequency of attack = 2%, attack intensity 98%, degree of attack 1,96%), 'Monroe' (sporadically attack), 'Akane' (frequency of attack 2,5%, attack intensity 100%, degree of attack 2,5%), 'Cortland' (frequency of attack 4%, attack intensity 100%, degree of attack 4%).

In 2004, 3 out of 47 varieties were attacked in the varieties collection (6.4%): 'Rome Beauty' (attack frequency 1%, attack intensity 90%, 0,9%), 'Akane' and 'Cortland' with sporadically attack.

For the bacterial fire blight (*Erwinia amylovora*) the most numerous attacks were registered in case of 'Jonathan', 'Idared', and 'James Grieve'. We noticed that the sensitivity of the trees, to this attack, is higher in chemical fertilized parcels.

Conclusions

1. The genetic resistance of the apple trees is an important pomicultural component in the ecological system.
2. The culture of resistant varieties allows on one side important economical accomplishments due to the reduced number of sprinkles and on the other side it protects the environment and the consumers.
3. From the study of 47 apple tree varieties resulted that the most resistant are:
 - **to the apple scab** (*Venturia inaequalis*): 'Quinte 208', 'Champion', 'Zvoncove', 'Haralson', 'Oldenburg', 'Ancuța', 'Empire', 'Macspur', 'Ardelean', 'Discovery', 'Red well', 'Carola', 'July Red', 'Mantet', 'Belren', 'Mc Intosh', 'Jonamac', 'Liberty', 'Monroe', 'Blaxtayman', 'Anka', 'Akane', 'Cortland', 'Rambo', 'Lobo', 'Goldspur', 'Yellow Newton';

- to the powdery mildew (*Podosphaera leucotricha*): 'Haralson', 'Winesap', 'Triple Red', 'Blaxtayan', 'Rambo', 'Lord Lambourne', 'Starkrimson', 'July Red', 'Penstayman';
 - to the black rot (*Monilinia fructigena*): the majority of the 47 varieties with the exception of 5: 'Lobo', 'Monroe', 'Akane', 'Cortland', 'Rome Beauty';
4. For the bacterial fire blight (*Erwinia amylovora*) the most numerous attacks were registered for 'Jonathan', 'Idared' and 'James Grieve' varieties. The trees from the land parcels intensely fertilized with chemicals were more sensitive to this bacteriosis.

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CERCETĂRI PRIVIND REZISTENȚA SOIURILOR DE MĂR LA BOLI – COMPONENTĂ DE BAZĂ A POMICULTURII ECOLOGICE

(Rezumat)

Rezistența soiurilor la boli este o componentă de bază a agriculturii organice. Cultivarea soiurilor rezistente permite, pe de o parte, realizarea de economii importante datorită numărului redus de stropiri, iar pe de altă parte protejează mediul ambiant și consumatorii.

Cercetările prezentate în lucrarea de față s-au efectuat în perioada 2003-2004, la Stațiunea de Cercetări Pomicele Bistrița și au avut ca principal obiectiv, studiul comportării a 47 de soiuri de măr, românești și străine, la atacul de rapăn (*Venturia inaequalis*), făinare (*Podosphaera leucotricha*), monilioză (*Monilia fructigena*) și foc bacterian al rozaceelor (*Erwinia amylovora*).

În anul 2003, la Bistrița, condițiile meteorologice au fost mediu favorabile evoluției tuturor agenților patogeni luați în studiu, iar în anul 2004 foarte favorabile.

În parcela experimentală s-a aplicat un minimum de tratamente fitosanitare (patru în anul 2003; cinci în anul 2004), dintre care obligatorii au fost cele preflorale, cu fungicide de contact. Postfloral s-au aplicat 1-2 tratamente cu fungicide sistemice.

Din studiul celor 47 de soiuri de măr a rezultat că cele mai rezistente soiuri sunt următoarele: la **rapăn** (*Venturia inaequalis*) – ‘Quinte 208’, ‘Champion’, ‘Zvoncove’, ‘Haralson’, ‘Oldenburg’, ‘Ancuța’, ‘Empire’, ‘Macspur’, ‘Ardelean’, ‘Discovery’, ‘Red Well’, ‘Carola’, ‘July Red’, ‘Mantet’, ‘Belren’, ‘Mc Intosh’, ‘Jonamac’, ‘Liberty’, ‘Monroe’, ‘Blaxtayman’, ‘Anka’, ‘Akane’, ‘Cortland’, ‘Rambo’, ‘Lobo’, ‘Goldspur’, ‘Yellow Newton’; la **făinare** (*Podosphaera leucotricha*) – ‘Haralson’, ‘Winesap’, ‘Triple Red’, ‘Blaxtayman’, ‘Rambo’, ‘Lord Lambourne’, ‘Starkrimson’, ‘July Red’, ‘Penstayman’. La **monilioză** (*Monilinia fructigena*) majoritatea celor 47 de soiuri, cu excepția a 5 soiuri (‘Lobo’, ‘Monroe’, ‘Akane’, ‘Cortland’, ‘Rome Beauty’), s-au dovedit a fi rezistente la această micoză. La **focul bacterian al rozaceelor** (*E. amylovora*) cele mai mari atacuri s-au înregistrat la soiurile ‘Jonathan’, ‘Idared’ și ‘James Grieve’.