RESEARCH REGARDING INTEGRATED DISEASES AND PESTS CONTROL IN APPLE TREE CULTIVATION IN THE CÂRCINOV-ARGES FRUIT GROWING BASIN

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Abstract
In tree culture technologies, regardless the species and varieties in culture, cessation and control of disease and pest attack represent important and necessary sequence, which influence the quantity and mainly the quality of fruit production, especially the biological potential transmitted for the next 2 -3 years.

Keywords: apple pest, disease resistant varieties, acaricides, fungicides, disease control

1. INTRODUCTION

In fruit technology, regardless the species and varieties in culture, prevention, cessation and control of disease and pest attack are important and necessary sequences, which influence the quantity and mainly the quality of fruit production, especially the biological potential transmitted for the next 2 - 3 years.

In the two fruit growing basins Voinesti–Dambovita and Cârcinov-Arges, under pedo-climatic aspect, good conditions are provided for tree growth and fructification, especially apple trees, and also for development of diseases and pest attack.

2. MATERIAL AND METHOD

The main apple diseases that require the most attention to control, as they mainly influence the fruit quantity and quality are:

- brown leaf spot and apple fruit scab produced by the fungus *Venturia inaequalis* (COOK) Wint., it has always been the main apple disease that affects the quantity and quality by 40-95% of fruit production, determine premature defoliation, early depletion and decline of trees;
- apple powdery mildew (*Podosphaera leucotricha* Ella. et. Ev.) attacks shoots, inflorescences and fruit in the early stages of development. It is specific for sensitive varieties such as Ionathan and Idared, and manifests itself as a whitish powdery felt on the attacked organs. This may produce considerable loss of production and biological degradation of the tree.;
- *Monilinia fructigena* is annihilated together with other diseases, and treatments are made to the warning and usually overlap with those for scab;
- Rosaceous bacterial fire blight - *Erwinia amylovora* (Burill) Regers et. Smith is a particularly dangerous disease for the sensitive apple varieties, often being confused with common apple black pit (*Pseudomonas syringae*) or even with the spur canker attack (*Monilia sp.*) .

There are also other diseases caused by viruses, bacteria, fungi, but with less negative impact on the plant.

Of pests, particularly important for their controls are:

- Apple blossom weevil (*Anthonomus pomorum* L.) is a specific apple pest with one generation per year. The damage is produced by the adult insect which consumes the flowering and vegetative buds, and the larvae, coming out from the egg which was deposited in the bud, consumes the internal organs of the flower. The buds no longer open, they become brown, dry and remain hanged on the branch, being known as “cloves”. (Figure 1).

- Apple moth - *Cydia pomonella* L. (sin. *Carpocapsa pomonella* L., *Laspeyresia pomonella* L.), has two generations per year and produces extensive damage in unkempt orchards. The larvae enter the fruit which presents excrement galleries around the hole penetration.
- Fruit skin moth - *Adoxophyes orana (reticulana)* is a very dangerous pest of apple tree orchards, causing significant damage by impairment of quality fruit.

Figure 1. Apple blossom weevil (left) and damage symptoms (right)

- San Jose scale (*Quadraspidiotus perniciosus* Comst) - in Romania's climatic conditions, the San Jose scale has 2-3 generations per year, often two generations. They pass the winter in the I larval stage under shield, on the tree stems and branches, the other stages disappear. (Figure 2).
- Fruit-tree red spider mite - *Panonycus ulmi* (sin. *Metatetranychus ulmi* Qud., *Tetranychus ulmi* Kock.) is a particularly harmful parasite which sucks sap from the leaf tissues. It has 5-6 generations per year and is annihilated only by special products - acaricides.]
- Oyster-shell scale (*Diaspidiotus ostreaeformis* Yard) has only one generation per year. It passes the winter in the II larval stage, under the shield, under the trees' bark.
- Woolly scale (*Eriosoma lanigerum* Hausm) has a complete cycle only in its area of origin (North America), having the American elm as a primary host plant and the apple tree as a secondary host plant. In Europe, the development of woolly scale is incomplete and occurs only on apple trees in viviparous manner.
- Apple green aphid (*Aphis pomi* De Geer) passes the winter in the egg stage at the base of thin branches and buds (Figure 3).
- Apple-leaf sucker (*Psylla mali* Schmidb.) has one generation per year, passes the winter in the egg stage on the tree branches (Figure 4).

The study was undertaken between the years 2006 – 2009, in a pilot batch, in Boţeşti village, Arges County, using different genetically disease resistant varieties: Ciprian, Generous, Florina, Pioneer, Prima, Voinea, in comparison with classical sensitive varieties - Ionathan and Golden Delicious. It was established a timetable for phytosanitary treatments for both resistant and sensitive species (Table 1).

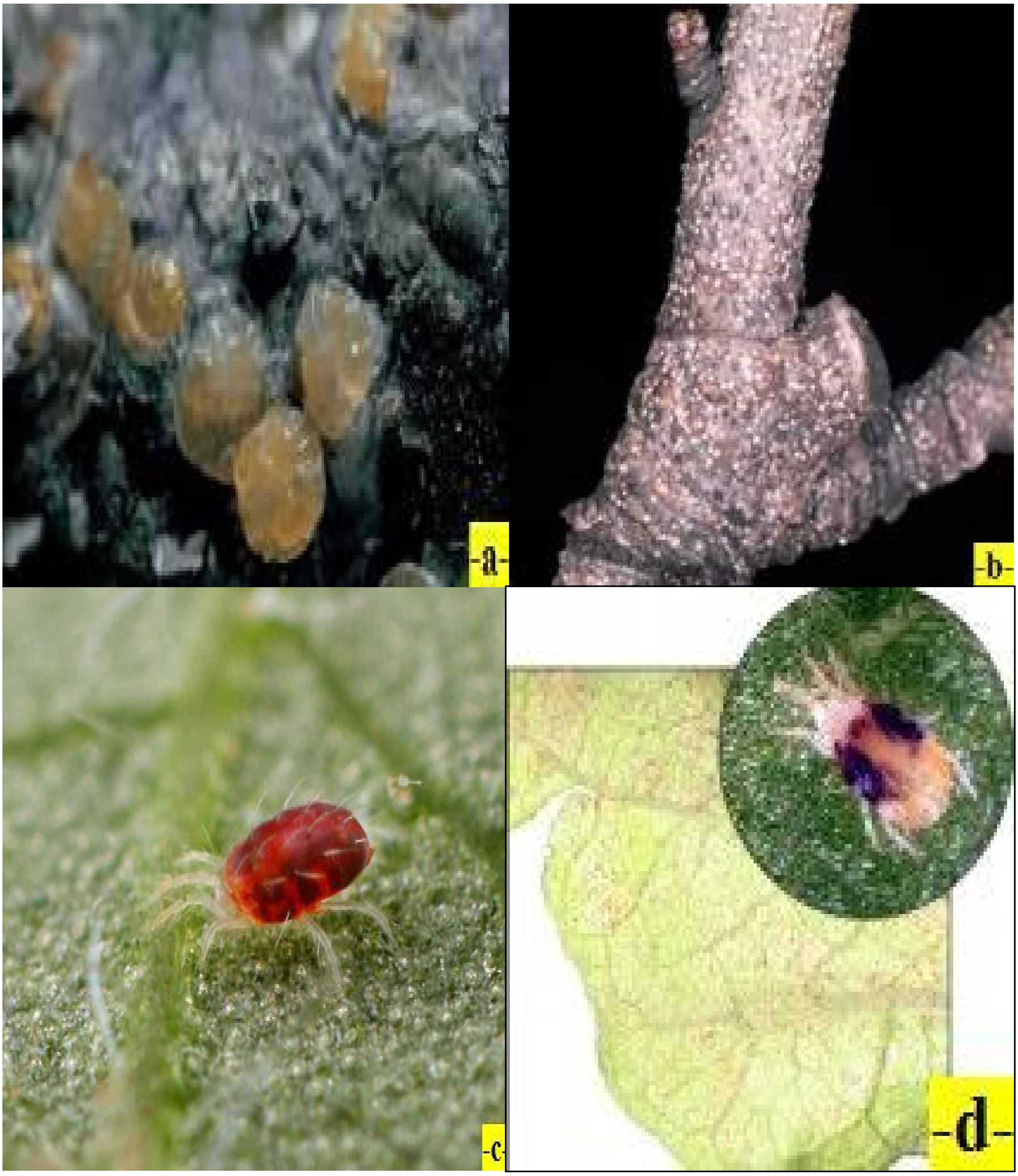

Figure 2. Pests and branches' attacks:
a - San Jose scal; b - branches' attack; c - fruit-tree red spider mite; d - apple red spider

Figure 3. Pests and annual growing attack: a – oyster-shell scale; b - wooly apple aphid; c – aphid on apple leaf; d – damage symptoms

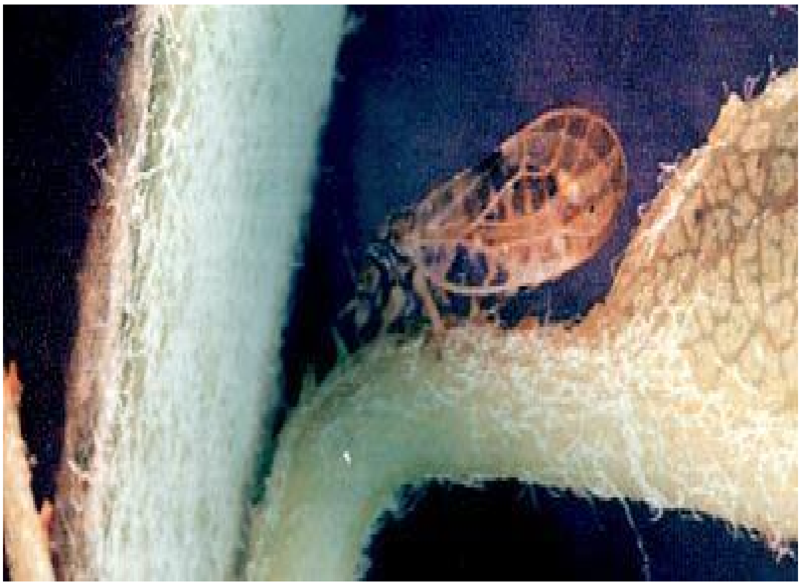

Figure 4. Psylla mali Schmidb (Apple-leaf sucker)

Table 1. Phytosanitary treatments calendar and sensitive apple annually applied pesticides in comparison with disease resistant varieties (Boţeşti 2006-2009)

Sensitive varieties						Resistant varieties			
No. treat.	Month (dec.)	Disease/ Pest	Product	Conc. (%)	Cantit/ ha (kg(l))	No. treat.	Product	Conc. (%)	Cantit/ ha (kg(l))
1.	III (3)	- powdery mildew - blossom weevil - defoliating pests	KumulusDF Fayfanon	0,3 0,3	4,5 4,5	1	Fayfanon	0,3	4,5
2.	IV (1)	- apple scab - bacterial fire blight - San Jose scale - mites	Confidor oil Alcupral 50PU	1,5 0,3	22,5 4,5	2	Confidor oil Alcupral 50 PU	1,5 0,3	22,5 4,5
3.	IV (2)	- apple scab - bacterial fire blight	Zeamă bordeleză Thiovit jet	0,5 0,3	7,5 4,5				
4.	IV (3)	- powdery mildew - apple scab	Chorus 75WG Folpan 80WDG	0,02 0,15	0,3 2,25				
5.	V (1)	- apple scab - powdery mildew - aphids - leaf miner	Chorus 75WG Merpan 0WDG Karate zeon	0,02 0,15 0,015	0,3 2,25 0,25				
6.	V (2,3)	- apple scab - powdery mildew - fruit worm G1 - leaf miner	Score 12 EC Folpan 80WDG Calypso 480SC	0,015 0,15 0,02	0,25 2,25 0,3	3	Calypso 480SC	0,02	0,3
7.	VI (1)	- apple scab - powdery mildew	Score 12 EC Folpan 80WDG	0,015 0,15	0,25 2,25				
8.	VI (2)	- apple scab - powdery mildew - San Jose scale G1	Shavit F72 Sinoratox 35EC	0,2 0,15	3,0 2,25	4	Sinoratox 35EC	0,15	2,25
9.	VI (3)	- apple scab - powdery mildew	Impact Dithan neotec	0,02	0,3				

		- leaf miner - mites - fruit worm GII	Seizer	0,2 0,05	3,0 0,75				
10.	VII (1)	- apple scab - powdery mildew - mites - fruit worm GII	Systane C Envidor	0,1 0,04	1,5 0,6	5	Envidor	0.04	0,6
11.	VII (2)	- apple scab - powdery mildew	Systan C	0,1	1,5				
12.	VII (3)	- apple scab - powdery mildew - fruit skin moth	Shavit F72 Proteus OD 110	0,2 0,05	3,0 0,75	6	Proteus OD110	0,05	0,75
13.	VIII (1,2)	- apple scab - powdery mildew - storage diseases - San Jose scale GII - wooly aphid	Topsin 70 Reldan 40 EC	0,1 0,15	1,5 2,25				
14.	VIII (3)	- apple scab - powdery mildew - storage diseases - San Jose scale GII	Carbendazin Reldan 40 EC	0,1 0,15	1,5 2,25	7	Carbendazin Reldan 40EC	0,1 0,15	1,5 2,25
TOTAL		Kg (l)			82,30				39,15
		%			100				47,28

Other rules of integrated pest control which must be followed are:

- treatments rationalization against pests (insects and mites) is performed during the whole period of vegetation, following the biology and the reserves sent from the previous year, critical life cycle moments, numerical density of the pest population, environmental conditions influence, the demand and the optimal time appliance of chemical treatments.
- the biological items mentioned are reported to the economic threshold of damage (ETD), specific for each pest, depending on which is established the need for chemical or biological intervention.
- the use of biotechnical and unpolluted instruments, which consist in attack monitoring and risk assessment using pheromone traps for a number of pests, such as mining larvae, apple tree worms, different leaf miners (Table 2).

Table 2. Types of pheromones used in apple insect population monitoring

No. crt.	Pheromone	Harmfull Species
1	***atraPOM***	***Cydia pomonella***
2	***atraBLANC***	***Phyllonorychter blancardella***
3	***atraSCIT***	***Leucoptera scitella***
4	***atraMAL***	***Stigmella mallela***
5	***atraNUB***	***Hedza nubiferana***
6	***atraORG***	***Orgya antiqua***
7	***atraPOD***	***Archips podana***
8	***atraRET***	***Adoxophyes reticulana***

It is important to mention that for biological pest and diseases control with major impact in ensuring fruit production, insect-fungicides were used at less toxic and safe doses for some parasitic insects, animals and humans. The warning insurance was based on the estimation of the population density in order to determine the pest critical level and its control using pheromones.

3. RESULTS AND DISCUSSIONS

In Romania, the Research and Development Station for Fruit Growing Voinesti has been and remains the disease and pest resistant promoter for apple varieties, both for local and foreign varieties, bringing varieties that will lead to an increased and competitive level on the Romanian market and to the development of an apple ecological fruit-growing production, as it is established and promoted in the European Community.

Data obtained in our research, regarding the economic and environmental effects are emphasized by the use of insect-fungicides and costs incurred in carrying out plant treatments, to 1 ha of orchard, as they are presented in table 3.

Table 3. Elements of economic efficiency of disease resistant apple genotypes compared with disease sensitive apple genotypes (2006 - 2008)

Specificație	Soiuri de măr sensibile	Soiuri de măr rezistente	Efecte economice (%)
Tratamente aplicate (nr.)	15	7	53
Consum insectofungicide (kg/) din care:	122	54	56
- fungicide (kg/l)	63	6	90
- insecticide-acaricide (kg/l)	59	48	81
Costuri (lei) din care:	5404	2045	62
- cu produse fitosanitare	3922	1345	66
- cu forță de muncă	562	280	50
- cu lucrările mecanice	920	420	54
Consum motorină-litri	90	42	53
- valoare (lei)	342	160	53

From the data presented, it is shown that between the two apple varieties cultivated are significant differences in terms of total number of treatments to the warning required during the vegetation period, pesticides quantities, diesel fuel consumption and costs. Thus, in vulnerable varieties orchard (Ionathan, Golden delicious), the average number of treatments was 15, while for the resistant varieties was 7.

Savings made in the orchard with resistant varieties by removing up to 90% of fungicides, and a reduction of 81% of insecticides and acaricides, represents 66% compared to vulnerable varieties, which means that in orchards with disease resistant varieties we may apply 50% less splashing and their value is 2 times lower than in orchards with typical sensitive variety. Also the diesel consumption is reduced by 53%, by reducing the number of crossings in the orchard for pesticide treatments.

4. CONCLUSIONS

In conclusion, it appeared that in the integrated control disease system a basic link are the genetic resistant apple tree varieties that highlight the their superiority in terms of economic efficiency (of fruit growers desire), less polluted fruit which provide health benefits to the consumers, and also their quality which is at least comparable to consecrated varieties.

In conclusion, the disposal of fungicides and using high-selected insecticides, coupled with the quality and productivity of genetic resistance to known diseases apple varieties justify the economic and environmental effects, and they are used as arguments to sustain this type of culture.

1. Promoting for culture the genetically disease resistant apple tree varieties is the main concept factor of integrated pest control (scab and powdery mildew).
2. During researches (2006-2009) in the apple tree orchards with disease-resistant varieties, there were applied an average of 7 plant treatments (mostly insecticides and acaricides) compared with sensitive disease apple varieties (Ionathan, Golden Delicious) which were treated 15 times annually.
3. The quantities of pesticide products (fungicides, insecticides and acaricides) used in the genetically resistant apple tree varieties orchard represent 47.28%, compared to those used in vulnerable apple tree varieties, meaning a total amount of 82.8 kg (l) in a vegetation season.
4. To the economic effects resulting from the promotion of apple varieties with genetic resistance to disease, we add the benefits of environmental protection, a quicker recovery of the natural predators and parasites populations and the maintenance of fruit quality standard.

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