CONTRIBUTIONS TO THE SETTING UP OF THE SYSTEM FOR INTEGRATED CONTROL OVER THE PATHOGEN MYCOTIC AGENTS IN THE APPLE CULTURE, FROM SIBIU COUNTY

Ana TIMAR

Departament for Agriculture and Rural Development-SIBIU-Romania
Phytosanitary Unit-Sibiu
Corresponding author: timar_ana@yahoo.com

Abstract: *The monitorisation of the pest agents, that are specific to the apple crop in Sibiu during 2006-2008, was meant to establish the annual strategies to the integrated defeat- the integrated menagement- of the fungus pest agents of the apple crop, keeping them under the limit of the economic level of the pest and the protection of the natural predator wildlife. The research was made every year through surface surveys, by samples of the organic plants having symptoms of an attack , in order to inventory the fungus pest agents, the imminent attack, and taking the decision to apply the phytosanitary treatments of the optimum moment. The analysis of the samples picked up from the ground was macroscopically and microcospically made Constantinescu (1974). The integrated combat is meant to have a permanent adaptation of the combat working systems to the ecological conditions of every microarea. That' s why, the combat systems must be corrected in accordance to the prognosis, warning, economical pest level, correlated to the entomophagus density, the presence or the lack of the selected pesticides. The research are both classical and modern, using as the modern warning methods of chemical treatment electronics, communications and informational systems Şuta V. (1980), Minoiu N. (1980) Comes I., Lazăr A., Drăcea A,Bobeş I., Hatman M.(1977), Minoiu N. (1980), Tănase C., Şesan E.T. (2006), Pârvu M. (2003), Iacomi B., Vlad F.F. (2006), Isac I. (2002), Sistemul AgroExpert. Knowing the fungus pest agents kinds that are present in the apple orchards, the assessment of their attack ,there are programs of phytosanitary treatment made in an integrated combat system of the pest agents in the microareas and in individual orchards.So there ca be applied the combat measures that are based on the mixture of the agrotechnical, physical, biological and chemical methods in the context of the offered agrosystem, only if it's economically justified.*

Key words: plant protection, integrated control, pest micotic agents

INTRODUCTION

In Romania, the idea of the integrated control against the pest on the crop plants appeared after 1970 (COMES I, LAZĂR AL. DRĂCEA A., BOBEŞ I., HATMAN M. 1977), as a practical necessity determined by many factors such as the excess of the chemical treatment that led to the alterration of the natural biocenotic equilibrium. In time, this new direction on the plant protection grew deeper and deeper, becoming „a system of the biocenoses adjustment by correlation and by the independence of the factors such as: the pathogenic plant agent, the environment and the technology" (BAICU T. 1972). The integrated control systems count on thje technological, ecological and economic element.

After the observations made in a few years, using different methods of the integrated control to prevent and to combat the two problematic pest agents (scab and powdery) to the sensitive apple varieties 11-12 to 17-18 (ŞUTA V. 1980, ŞUTA V., ISAC 1982, MINOIU N., BOBEŞ I., GHIZDAVU I.1993, MINOIU N., BOBEŞ I., GHIZDAVU I. -1993, MINOIU N., PLATON V., FLORIAN V., GHIZDAVU I., TOMŞA M., GRIGER S.-2001), and to the variety that are genetically resistant up to 6-8 phytosanitary treatments/year (MINOIU N., FLORIAN V., TOMŞA M.-2001).

MATERIAL AND METHODS

The biological material used in the experiment consisted of plant organs (branch, leaves, fruit) during the vegetative period of the trees and during the vegetative repau. The researches are of classical type mixed with the modern research, using the modern warning for the chemical treatment, using the electronic informational system and communication (the Agro Expert System).

The microscopic and macroscopic analysis was made in the diagnosis lab of the Phytosanitary Department of Sibiu, using the classic phytopatological and micological methods to isolate and to identify the pathogens (HULEA A.-1969, CONSTANTINESCU O.-1974, PÂRVU M. - 2003).

The collected data on the spot and the outcome got in the lab for the pest agents *Podosphaera leucotricha* and *Venturia inaequalis* were correlated to the information issued by the AgroExpert System.

During the vegetation, the evaluation of the attack of the pest mycotic agent was made according to the" list of the main pest agents of the plant crop and the evaluation of their attack" No.1 Annex issued by Central Laboratory of the Phytosanitary Quarantine Bucharest, 1997.

In autumn in order to establish the potential dose of the acospores (P.D.A) and the risk for the attack for the following year, there was used the method presented by ORTS R., GIRAU L., DARTHOUT L.– IACOMI B., VLAD. F.F., 2006.

RESULTS AND DISCUSSIONS

For a rationally combination of the different methods of combat, it is necessary to creat an organizational agrotechnical base, as a support for applying different methods. This base of the integrated control system of the mycotic agents in the friut browing ecosystem includes: the variety, the environmental factors, the agrosystem study, the agrotechnical measures, the prognosis and the warning.

1. The apple varieties in the orchards that are 20 years old are: Jonathan, Idared, Generos, Florina, Golden, Starkrimson grafted on the 106 stock, while the apple tree planted in 2005 is part of the Fuji kiku, Gala schnitzer and Golden delicious, that were grafted on the M9 stock.

2. The environmental factors registred in 2008-2009 in the microzone of Apoldu de Sus are presented in Table 1.

Table 1

The average temperature (^{0}C), the annual average humidity (U%), the rainfalls (l/mp) registred in the Apoldu de Sus microzone, during 2008-2009 (the source – the Phytosanitary Department of Sibiu, taken by *Timar A.*)

Year	The Forecast Data – annual adverage				The Forecast Data – annual sums	
	Temperature ^{0}C		Humidity %		Rainfall l/mp	
	2008	2009	2008	2009	2008	2009
Annual values	10,0	10,5	79	76	750,6	633,0

3. The study of the apple tree agrosystem in Sibiu county as a lasting assembly.

The fruit growing areas were classified by the quantity of the inoculum of the present mycotic agents, according to the unit number of the P.D.A that preceeds the crop.

During 2008-2009 the evolution of the mycotic pest agent was noticed in two ways of the Integrated Control System (I.C.S) such as:

V1) the ICS-the chemical measures (the chemical treatments), the agrophytotechnical measures (the grooming operations,, the lawns, the applications of the foliar fertilizers, the herbicides);

V2) the ICS-the chemical measures (the chemical treatments), the agrophytotechnical measures (only lawns on the raws and between the trees raws).

Table 2

The applied measures during 2008-2009, the biological reserve of the complex of the mycotic pest agents, the risk of the attack of the mycotic pest agents for 2009-2010

No	The orchard The microzone of Apoldu de Sus	The applied fungisideo of the IBS type in 2008	The applied measures during the vegetation period in 2009	The applied measures in autumn-winter in 2009	The risk of the scab in 2010 (DPA)	Other mycotic pest agents
V-1	4 year old orchard The variety: Gala schnitzer Fuji kiku, Golden delicious	yes	Chemicals, Foliar fertilizers Plowing, Mowing Herbicides Grooming	Chemical Plowing Grooming	very low	***
V-1*	4 year old orchard The variety: Gala schnitzer Fuji kiku, Golden delicious	yes	Chemicals mowing	Chemical	low - moderate	***
V-2	20 year old orchard The variety: Jonathan, Idared, Starkrimson, Golden auriu	yes	Chemicals Foliar fertilizers Plowing Mowing Herbicides Grooming	Chemical Plowing Grooming	moderate	****
V-2*	20 year old orchard The variety:Jonathan, Idared, Starkrimson, Golden auriu	yes	Chemicals, mowing	Chemical	high	*****

Legend: *** = *Venturia i., Podosphaera l., Monilinia f.*

**** = the complex of the mycotic agents - *Venturia i., Podosphaera l., Monilinia f., Gleosporium a., Alternaria spp.* .

***** = the complex of the mycotic agents - *Endostigme i., Podosphaera l., Monilinia f., Fusarium spp., Alternaria spp., Nectria g., Phomopsis m., Cytospora spp., Gleosporium a.*.

Alternaria spp. and *Fusarium spp.* did not have the specific symptoms of the attack on the plant organs, but they were only microscopically identified on the old leaves that presented the symptoms of the attack of *Venturia inaequalis*. (this fact was signaled by ŞESAN E.T., 2007).

4. The prognosis and the warning according to the biological reserve in the previous years,to the phenology of the varieties and the weather conditions during 2008-2009 there were recommended the phitosanitary treatments against the main mycotic pest agents presented in Table 4. The phitosanitary treatments were differently applied according to the phenology of the variety up to the petal jolt and the resistance of the pathogen types.

To support the making up of an adequate programme of the integrated control against the mycotic pest agents, a station was installed to measure the forecast, the piece of an AgroExpert System that broadcast the forcast data (temperature, humidity, of the rainfall, the presence of the water drops on the leaves) in a receiver of the computer.

The receiver analyses the received information and sends the messages about the infected conditions and the optimal time to apply the phitosanitary treatments for the attachment allgorithms, such as *Podosphaera l*. and *Venturia i.*

Table 3

The AgroExpert measure station, the number of the recommended phitosanitary treatments to combat the *Podosphaera l.* and *Venturia i.* for the sensitive apple varieties

The location of the AgroExpert measure station	Număr tratamente					
	Podosphaera leucotricha			*Venturia inaequalis*		
	The number of the recommended treatments in the classic system	The number of the recommended treatments in the electronic system	% electronic treatment system	The number of the recommended treatments in the classic system	The number of the recommended treatments in the electronic system	% electronic treatment
Apoldu de Sus	12	10	83,3	12 (11vegetations+1 after the harvest)	9 (8 vegetatione+1 vegetative repau)	66,6-75,0

The data offered by the AgroExpert System were corrated the observations made on the area in order to make up the real short lasting prognosis.

In the classic system of the vegetation period of the sensitive varieties to the mycotic pest agents by correlating the bological, ecological and phenological factors of the classic system, the conditions set for the 12 phytosanitary treatments for the *Podosphaera leucotricha* and 11 phytosanitary treatments for *Venturia inaequalis* for *Venturia i., Monilinia f.* and other bark disease, it was recommendec to apply a treatment at the beginning of the leaf jolt, to diminish the biological reserve, from the trees and the leaves that fell on the ground.

During the years of study there were warned the phitosanitary treatments to combat the mycotic agent of the apple this way:

- up to the phenophase of the jolt-the moment to apply the phitosanitary treatments, it was recommended to apply the treatment according to the phenology of the crop, but differently on the existant varieties in the orchards and the existant reserve of the mycotic agents. The treatment „before the blooming" is a „key" treatment because during the years of study there were accomplished all the conditions to produce the fungus attack (the biological reserve, the ascospores, the leaves, the rainfall, the humidity projection).

- after the phenophase of the „jolt" the optimal time of the treatment was recommended according to the biology of the present mycotic agents (P*odosphaera l., Venturia i., Monilinia f.)* and the products on the plant protection used in the previous treatments. The recommended and applied phytosanitary treatments in the orchards are presented in Table 4.

*The treatment is repeated in the case of the washed product (the protection is poor when there are 20-30 mm rainfall), the intense vegetative growing were in the previous treatment, it was used a plant protection product with a contact action (the leaves after the treatment are not sufficiently protected, excepting the case when a systemic product is needed).

The applied chemical treatments had a stopping effect when the risk was reached:

a) with a product for contact or preventive in the 24 hours after the innitial period of the wet favourable to the infection;

b) with a curative product (the IBS – the Inhibitor of the Stereol Biosy) in 3-5 days after the beginning of the leaf wet (according to the product).

On the plowing plots on the trees raws the sudden growing of the flora, especially the monocotyledonous weeds, during the 2 years, a huge powdery degree was present, a symptom that appeared much later on the leaves and the offshots.

Table 4

The period of recommendation of the phytosanitary treatments for the complex of the mycotic pest agents during the period of the application of the phytosanitary reatments to the apple crop in 2009

Treatment no.	The phenological phase of the crop the fought mycotic pathogen	The warning issue for the sensitive varieties	The application of the phytosanitary treatment		Applied foliar fertilizers
			Sensitive variety	Resistant variety	
1.	When 10-15% of the floral buds are unbudded *Podosphaera l., Nectria g., Cytospora spp.*	26 march	26-28 march	26-28 march	No
2.	Inflorescence spreading to blossoming *Podosphaera l., Venturia i., Monilinia f., Nectria g., Cytospora spp.*	13 april	22-23 april	22-23 april	Yes
3.	When 10-15% of the flowers started the petal jolt *Podosphaera l,. Venturia i., Monilinia f., Nectria g., Cytospora spp.*	23 april	04-05 may	04-05 may	Yes
5.	*Podosphaera l., .Venturi i., Monilinia f., Gleosporium a., Nectria g., Phomopsis m.*	18 may	20-22 may	-	Yes
6.	** Podosphaera l, .Venturia i.., Monilinia f, . Gleosporium a., Nectria g., Phomopsis m.*	28 may	-	28-30 may	Yes
7.	*Podosphaera l., Venturia i., Monilinia f, Gleosporium a., Nectria g., Phomopsis m.*	05 june	-	-	
8.	*Podosphaera l., Venturia i., Monilinia f., Gleosporium a., Nectria g., Phomopsis m.*	29 june	30 june- 02 july	-	Yes
9.	*Podosphaera l.Venturia i. , Monilinia f., Gleosporium a, Nectria g., Phomopsis m.*	22 june	-	-	-
10.	*Podosphaera l., .Venturia i., Monilinia f., Gleosporium a., Nectria g., Phomopsis m.*	01 july	1-3 july	1-3 july	No
11.	*Podosphaera l., Venturia i. , Monilinia f., Gleosporium a., Nectria g., Phomopsis m.*	30 july	-	-	
12.	*Podosphaera l, .Venturia i. , Monilinia f., Gleosporium a., Nectria g., Phomopsis m.*	24 august	26 august	26 august (excepting Gala)	No
13.	*After the harvest Venturia i. , Monilinia f., Nectria g., Cytospora spp,. Phomopsis m.*	october	12-14 november	12-14 november	No
Treatment no. 12 - *Podosphaera l.,* 12 *Venturia i.*		13	8	7	-

In Table 5 and the continuing Table 5, there are presented the degrees of the attack and the frequency of the attack on the main micromicets before the apple crop until the end of augustand .

The foliar fertilizer were applied after the knowledge of the soil charts and did not replace the base fertilization of the soil.

Comparing the values of the attacking degrees that were lower in V1 and V2 varieties and V1* and V2*, it can be drawn the conclusion of both that benefit of the complex agrotechnical measures and the foliar fertilizers that have a positive effect in the biochemical process of the plant.

Table 5

The apple varieties' reaction to the main micromicets in the differential integrated control system in 2008-2009,after the complex applied measures in variants

The variety	The Integrated Control System (I.C.S) V -1,2			The Integrated Control System (I.C.S) V1*,2*		
	year 2008			year 2008		
	Podosphaera l.	*Venturia i.*	*Monilinia f.*	*Podosphaera l.*	*Venturia i.*	*Monilinia f.*
	GA% (leaves)	GA% (leaves)	F %(fruit)	GA% (leaves)	GA% (leaves)	F %(fruit)
Jonathan	10,8	9,7	0,5	14,5	10,2	0,5
Idared	10,2	8,2	0,3	12,1	11,0	0,4
Starkrimson	5,4	10,1	0,4	6,9	11,5	0,5
Golden	7,8	6,7	0,3	9,5	7,3	0,6
Generos	5,0	2,0	0,1	5,4	4,1	0,2
Florina	6,0	2,2	0,5	6,5	3,5	0,4
Fuji kiku	7,2	4,8	0,1	7,5	5,9	0,2
Gala schnitzer	6,0	5,2	0,1	8,2	7,0	0,3
Golden Delicious	7,3	6,3	0,3	7,9	7,9	0,3

Continuing Table 5

The variety	The Integrated Control System (I.C.S) V-1,2			The Integrated Control System (I.C.S) V-1* 2*		
	Year 2009			Year 2009		
	Podosphaera l.	*Venturia i.*	*Monilinia f.*	*Podosphaera l.*	*Venturia i.*	*Monilinia f.*
	GA% (leaves)	GA% (leaves)	F %(fruit)	GA% (leaves)	GA% (leaves)	F %(fuit)
Jonathan	12,2	7,1	0,7	14,2	9,2	0,7
Idared	10,1	7,0	0,2	12,1	10,4	0,3
Starkrimson	8,2	8,6	0,5	10,5	10,6	0,5
Golden auriu	6,7	7,5	0,6	7,3	8,3	0,7
Generos	3,0	2,2	0,2	5,4	2,5	0,2
Florina	5,8	2,6	0,4	6,3	3,2	0,5
Fuji kiku	4,2	4,0	0,2	5,2	5,7	0,3
Gala schnitzer	5,1	5,4	0,3	6,1	6,2	0,3
Golden Delicious	6,4	6,2	0,4	7,2	8,1	0,5

Legend: G.A.% = F%x I/100 (G.A. = the attack degree, F= the frequancy of the attack, I = the intensity of the attck).

The outcome of the study made to prevent and to combat the pest mycotic agents in the apple crop is presented in the scheme of the Integrated Control System in 2008-2009 presented in Figure 1.

CONCLUSIONS

The integrated control can be considered as a „new tactic strategy „ in the combat with the mycotic agents on the apple plants.

- The introduction of the resistant genetic variety of the mycotic agents in order to reduce the usage of the pesticides that have a negative impact over the consumers' health and the environment (7-8 phytosanitary treatments/year).
- The adjustable treatments, especially the chemical ones can be applied , using the prognosis and the warning (based on the biological cycles, the sesibility of the crop variety towards the different pathogens, the biological reserves of the infection source of the previous year, the phenological phases of the tree growing, the moments when the trees are susceptible for infections, the climate conditions).

➢ The practice of warning for the applying treatments in the last years proved the necessity of their improvement, correlating the exact information offered by the electronic informational systems to the observations made on the ground.

➢ During 2008-2009 in the pedoclimatic conditions of the microclimate in Apoldu de Sus, it was recommended to apply 11-12 phytosanitary treatments to the sensitive varietyand 7-8 treatments to the resistant variety to the mycotic agents for the complex of the mycotic agents

➢ Some of the 20 year old varieties are more genetically sensitive to the mycotic pest agents compared to the younger ones, the sensibility being obvious because of the degrees of the attack presented in V1, V2.

➢ There were applied the same range of the plant protection product to all the variety in the V1 and V2 varieties the degrees of the attack (D.A.) were lower compared to the higher values registred in V1* and V2* variants, the degrees of the attack because of the lack of the application of the complex of the afrotechnical measures meaning the lack of the foliar fetilizers the plowings, the herbicides eventually.

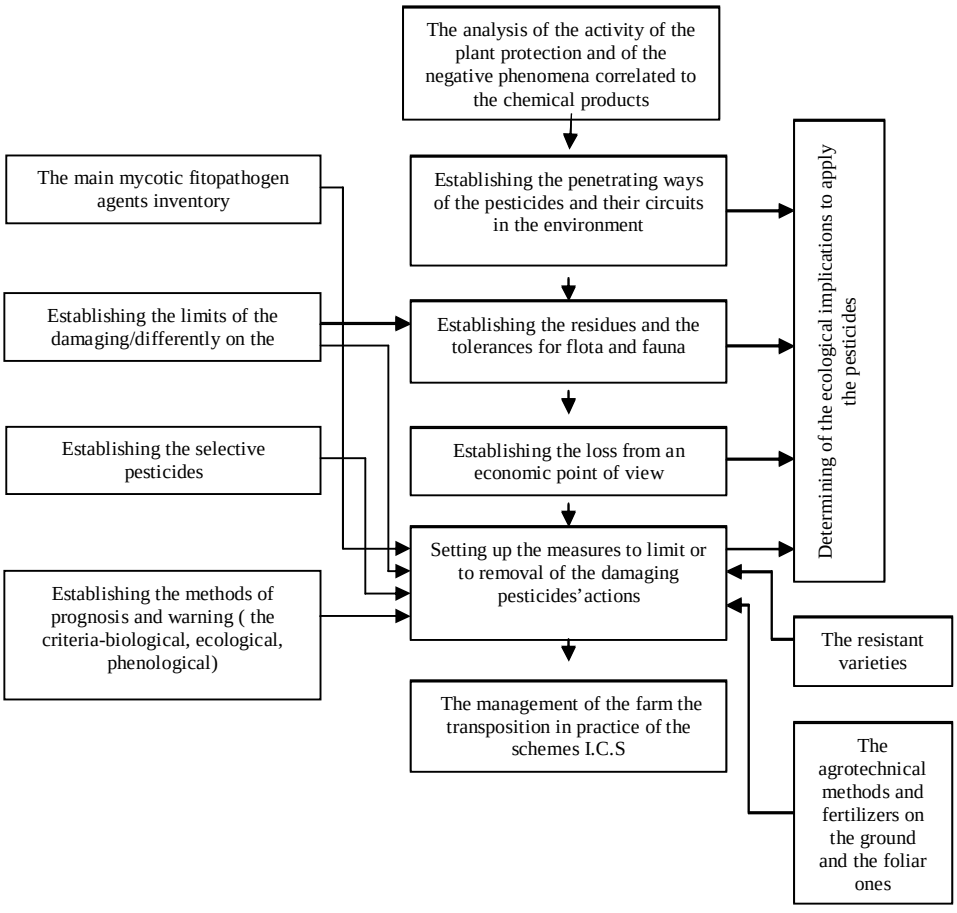

Figure 1: The scheme of the integrated control of the mycotic pest agents in the apple crop

- The foliar fertilizers that were used had also an effect on the leaf protection as a result of the content of some chemical forms and adequate concentration of the macroelements (N,S, K,Mg) and microelements (Fe, Mo, Mn, Cu, Zn, Co, B) and thus the used fertilizers on the plant organs form the persistant strata of the hydroxides and basic salts colloidally spread, that are like a barrier against the microscopic pathogen fungus.

➢ By the embodyment of the leaves in the soil in the autumn or spring plowings the biological reserve of the fungus that stays over winter in the fallen leaves is reduced.

➢ Various species of the spontanuous flora are part of the host-plants for different pathogen agents *Convolvulus a., Trifolium spp.* – represent the host-plants for powdery, a common disease of the excessive hunger that lays on the apple leaves. Their elimination from the orchards and the proximity of the nearby crop zones are obligatory.

➢ The management of the tree farms as a complex structure meant to highly evaluate the ecopedoclimate of the crop zone in the conditions of diminishing the conventional energy consumption in order to get the crop and in the conditions of diminishing the negative impact over the environment.

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