THE CONTROL AND MONITORING OF THE ORCHARD PESTS IN TRANSYLVANIA

CONTROLUL ŞI MONITORIZAREA DĂUNĂTORILOR LIVEZILOR ÎN TRANSILVANIA

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Abstract: *Monitoring the biological supply of nine orchard mite species with special economical importance in middle Transylvania, was the aim of our paper. Besides usually monitored species (Quadraspidiotus perniciosus, Anthomus pomorum, Hoplocampa testudinea, Hoplocampa minuta, Cydia pomonella, Cydia funebrana şi Rhagoletis cerasi), other two were also considered (Janus compressus şi Eurytoma schreineri) because in last years were identified within tree plantations, and their population is in continuous increase and in several plantations became key mites. The classical monitoring method was used. The monitoring activity revealed the presence of the Quadraspidiotus perniciosus, phytosanitary quarantine specie was encountered in more than 80% of tree plantations, but biological supply was maintained on marginal rows or points difficult to access for chemical works. Paper originality consists in emphasizing the presence of Janus compressus in apple and pear trees and Eurytoma schreineri in plum tree. The practical aspects revealed by this paper underline the importance of this kind of approach for the warning campaign against orchard mites and performing chemical treatments.*

Rezumat: *Scopul lucrării de faţă îl reprezintă monitorizarea a nouă speci de dăunători de importanţă economică pentru livezile din Transilvania. Pe lângă speciile monitorizate uzual, (Quadraspidiotus perniciosus, Anthomus pomorum, Hoplocampa testudinea, Hoplocampa minuta, Cydia pomonella, Cydia funebrana şi Rhagoletis cerasi), au mai fost luate în considerare şi alte două (Janus compressus şi Eurytoma schreineri) datorită faptului că în ultimii ani au fost identificate în plantaţiile pomicole, iar populaţiile lor sunt în continuă creştere astfel încât în unele cazuri au devenit dăunători principali. Au fost utilizate metodele clasice de monitorizare. Prezenţa Quadraspidiotus perniciosus a fost semnalizată, o specie de carantină fitosanitară, care şi-a manifestat prezenţa în mai mult de 80% dintre livezi, dar rezerva biologică a fost concentrată pe rândurile marginale şi în punctele greu accesibile pentru tratamentele chimice. Originalitatea lucrării constă în evidenţierea prezenţei speciilor Janus compressus la culturile de măr şi păr şi Eurytoma schreineri la cele de prun. Aspectele practice prezentate evidenţiază importanţa acestui tip de abordare pentru campanile de avertizare şi pentru efectuarea tratamentelor chimice.*

Key words**:** *mites, orchard, phytophagous species, monitoring*
Cuvinte cheie**:** *dăunători, livadă, specii fitofage, monitorizare*

INTRODUCTION

The performed study mainly aimed to record the arthropods dynamics within tree plantations. The harmful vegetal and animal organisms can often be not observed, and when the environmental conditions are favourable, they strongly multiply their number and produce serious damage in tree plantations (SOLOMON, 1992; WELTY CELESTE, 2002).

Performing appropriate phytoprotection in tree plantations, supplying qualitative superior production may be obtained by correct putting into practice of the integrated fight principle. Taking all appropriate measures, whatever their nature, in order to maintain the pathogen agents, mites and weeds within a population level, which can be supported by plant

level, is imposed. The importance of each method belonging to the integrated fight concept is imposed by the concrete state of art of each organism that must be destroyed. This explains the importance of the accurate knowledge of the mites and disease complex present in each plot and appropriate estimation of the economical importance of each organism (OROIAN I., 2008).

MATERIAL AND METHODS

The research was performed in Cluj and Reghin – Batoş (county of Mureş) three plantations, in 2008. The biological pool of nine pest species with economical importance for the three plantations was studied.

For seven (*Quadraspidiotus perniciosus, Anthomus pomorum, Hoplocampa testudinea, Hoplocampa minuta, Cydia pomonella, Cydia funebrana* şi *Rhagoletis cerasi*), of nine studied species, warning bulletins are delivered by the Laboratories of Prognose and Warning. The other two species (*Janus compressus şi Eurytoma schreineri*) were observed because in the last years were recorded in tree plantations, and their populations are increasing and in some plantations they became key pests.

Monthly observations were performed in tree plantations in order to estimate the attack produced by these pests. In evidence records, controlled area, and attacked areas were specified for each pest. Observations concerning attack frequency were also performed and four hierarchy classes were established: weak, moderate, strong and very strong. Fruit samples were taken and submitted to examinations. The statistical analyze was performed using STAT v. 6.0.

RESULTS AND DISCUSSIONS

The results of all observations concerning the spreading and attack degree produced by eight studied species is presented (table 1).

Table 1

The attacked areas predated by the main phytophagous species in 2008, in tree plantations (Cluj and Reghin – Batoş)

Month	Parasite	Controlled	Without attack, Ha	With attack, Ha	Weak attack, Ha	Moderate attack, Ha	Strong attack, Ha	Very strong attack, Ha
I	*Quadraspidiotus perniciosus*	237	29	208	147	52	9	-
II	*Quadraspidiotus perniciosus*	272	36	236	186	38	12	-
III	*Quadraspidiotus perniciosus*	328	54	274	199	47	20	8
IV	*Anthonomus pomorum*	178	45	133	110	21	2	-
V	*Anthonomus pomorum*	293	61	232	164	32	21	15
	Hoplocampa testudinea	315	208	107	79	28	-	-
	Hoplocampa minuta	307	110	197	105	82	10	-
VI	*Hoplocampa testudinea*	485	270	215	111	45	31	28
	Cydia pomonella	620	292	328	283	42	3	-
	Hoplocampa minuta	362	141	221	158	39	21	3
	Rhagoletis cerasi	18	5	13	2	5	6	-
	Janus compressus	485	195	290	213	71	-	6
	Eurytoma schreineri	278	69	209	55	79	40	35
VII	*Cydia pomonella*	270	120	150	62	51	37	-
	Quadraspidiotus perniciosus	650	34	616	480	106	25	5
	Rhagoletis cerasi	78	12	66	42	19	3	2
	Janus compressus	508	187	321	217	87	4	13
	Eurytoma schreineri	316	78	238	70	65	62	41
VIII	*Quadraspidiotus perniciosus*	788	29	759	515	201	37	6
	Cydia pomonella	370	150	220	111	79	30	-
IX	*Quadraspidiotus perniciosus*	289	15	274	126	92	50	6
	Cydia pomonella	990	20	970	385	540	25	20
X	*Quadraspidiotus perniciosus*	742	29	713	472	199	14	28

An average number of 399.08 sites were controlled, and in 95.17 the attack was not encountered, but in 303.91 was observed (table 2, figure1).

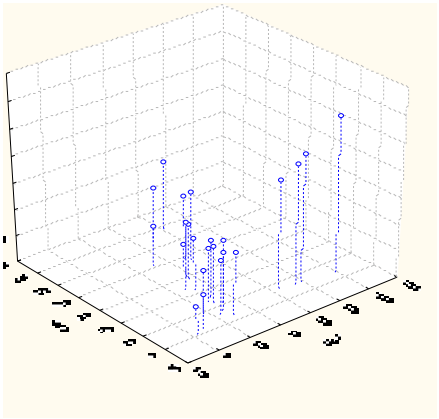

Figure 1. The average number of attacked and non attacked records in controlled sites

The results show us that 23.84% of the averages of controlled areas were not attacked, but 76.14% were the subject of pest action. The weak attack intensity was of biggest share (62.83%), while strong (6.61%) and very strong attack (1.68%) occupy a very small share by (table 2).

Table 2

The averages and dispersion parameters calculated for attacked areas predated by the main phytophagous species in 2008, in tree plantations (Cluj and Reghin – Batoş)

Issue	n	$\overline{X} \pm s_X$	% of average attack degree from controlled and/or attacked
Controlled	23	399.08 ± 48.30	
Without attack, Ha	23	95.17 ± 17.79	23.84
With attack, Ha	23	303.91 ± 49.03	76.14
Weak attack, Ha	23	190.95 ± 30.06	62.83
Moderate attack, Ha	23	87.82 ± 22.96	28.89
Strong attack, Ha	23	20.08 ± 3.55	6.61
Very strong attack, Ha	23	9.39 ± 2.61	1.68

- *Quadraspidiotus perniciosus*

In 2008, the presence of this specie of phyto-sanitary quarantine was observed in over 80 % of controlled areas, with different attack degrees. In January – March, the pest was observed in over 83% of monitored areas, on the following tree species, especially: apple, plum, pear, quince trees. On the infested areas, a weak attack degree is predominant (147 Ha in January, 186 Ha in February and 199 Ha in March). In many of controlled areas, with weak attack degree, the pest was observed on the trees from hardly accessible areas for sprinkling devices and on marginal rows, close to ditch areas, especially, where a half of tree crown remains untreated, generally.

Areas with very strong attack were also observed. They belong to the last Inter-cooperating Associations (Căşei in the county of Cluj, Breaza in the county of Mureş) which are now dilapidated, or to former I.A.S. maintained by some commercial societies, presently, but which possess deficient culture technologies. In Reghin area, we observed two plots, 8 Ha

each, cultivated with apple, where the attack incidence was of 87%. Because these areas are very close to the private tree plantations owners (the former Agroindustriala Reghin S.A.) they represent a real threat for the apple cultures from these units, which are big apple producers, generally. The observations performed during the vegetation period, revealed relatively strong attack degree. In August, from 788 monitored Ha, the attack was moderate in 759 Ha, strong in 14 Ha attack, and very strong in 28 Ha. Because it will enter in the period of vegetative spell with a relatively big biological supply, we can presume that in 2009 the attack produced by this specie will be strong.

For fighting against this pest, the Centre of Prognosis and Warning delivered 3 warning bulletins, one during vegetative spell, and other during vegetation period.

➢ *Anthonomus pomorum*

The apple tree weevil becomes again an economical importance pest, being encountered more and more often in apple plantations. In April, from 178 observed Ha, on 133 Ha (74.7%) the presence of the pest was signalled. On the attacked areas, the pest populations are small, on 110 Ha the recorded attack being weak. Only on 2 Ha the population density was very high, destroying over 95% of the flowers (Suceag, county of Cluj).

In May, the specie was encountered on 232 Ha from inventoried 293 Ha. For this time, also weak attack predominate (164 Ha). On 15 Ha located by four plots, the attack was very strong, the frequency of the attacked flowers being over 87% (Căşei – Cluj, Breaza – Reghin). The economical damages produced by this pest are very big when the differentiation of the flower buds is deficient and when in the flowering period act climatic factors strongly affecting the flower forming. A single treatment was announced for this pest, recommending the 0.5% Carbetox product.

➢ *Hoplocampa testudinea* and *Hoplocampa minuta*

Due to the specific biological cycle, of the apple saw fly (*H. testudinea*) and plum saw fly (*H. minuta*) are hardly to fight, generally. For these species is very important to precisely establish the moment of the intervention in order to be sure of the efficacy of the fight product. When the biological supply is high and the owner has enough material capacity for treatments correct application, two treatments are recommended: one before flowering, and the second, the most important, when petals begin to fall. Because the same larva may attack several fruits many times, the application of another treatment is imposed in order to protect fruits for a longer period.

In May, from 315 monitored Ha, cultivated with or moderate (28 Ha) attack degree. In June, even the attacked areas remained almost the same, the attack frequency increased. From 215 attacked Ha, on 111 Ha weak, on 45 Ha moderate, on 31 Ha strong and on 28 Ha very strong attacks were recorded. The biggest attack frequency was recorded in summer apples.

In the areas cultivated with plum trees a *H. minuta* much strong attach degree was observed. In both observations the attacked areas were over 60% of the controlled area. In May, from 307 verified Ha, the specie was observed on 197 Ha, on 105 Ha weak, on 82 Ha moderate and on 10 Ha strong attack degrees. In July, on 21 Ha (Apahida – Cluj) strong and on 3 Ha very strong attack degrees were observed. On these areas, 76% and 96%, respectively, of fruits were destroyed. This specie still represents a threat for the isolated plum trees, but also for the plantations with deficient phyto-protection.

➢ *Janus compressus*

In this specie, due to their constitution, the females are able to perform incisions on offshoots where lately, they place their eggs. After 14 - 20 days, the larvae are hatching and they will be fed with the medullar tissue of the offshoot, eating a gallery oriented towards the offshoot basis. As attack consequence, the young offshoots fane beginning from the incision level, fold like a crutch and finally fane.

At first sight, the attack aspect is similar to the symptom caused by *Erwinia amylovora* (wild fire) and at some extent like that caused by *Podosphaera leucotricha* (powdery mildew). The deep examination of the infested offshoots emphasizes the presence of some small long black stains, characteristically disposed by light spiralled rows. This appears more clearly on smooth pear offshoots and with slight difficulty on apple offshoots, which bear a recumbent outgrowth, more or les dense, masking the incisions. In this year the young apple plantations the frequent attack was of 20 - 25%, some trees having only 1 - 3 infested offshoots, but others with all offshoots infested. Even the specie was recently observed in Transylvania, it reach anxious population density. In June 59.8% of verified areas had attacked offshoots. Even though, during this observation of 290 attacked Ha, 213 Ha exhibit weak attack (lots with sporadic attack). On Cluj area, on 71 Ha moderate, and on 6 Ha, very strong attacks were recorded. In June observation, the attack frequency was more accentuated, increasing the areas with strong attack. From 321 attacked Ha, on 217 Ha weak, on 87 Ha moderate, on 4 Ha strong, and on 13 Ha very strong attack degrees were recorded.

This specie, not well known by cultivators and specialists, must be specially monitored in order to recommend special treatments for efficient fight.

➢ *Eurytoma schreineri*

This specie is oligophagous and attacks the forming fruits of kernel species, in the first place plum, and seldom cherry or sour cherry trees. The larva consumes the seeds. In one fruit one single larva can develop. The attacked fruits can hardly be differentiated by the healthy ones, because in exterior hey do not present symptomatology. Often, the massive fruit falls is put on the physiological causes or drought effects. After fruit falling on the soil, they became brown and have a mummy aspect with a nipple laterally placed towards one of the two extremities.

In 2008, this pest produces the biggest damages in plum tree plantations. Over 75% of plum tree plantations are attacked by this pest. A significant share has the areas with strong and very strong attack degree. In June, on a 35 Ha area, over 90% of fruits were attacked, and fall. In July, 41 Ha were compromised due to the attack produced by this specie.

➢ *Cydia pomonella*

The apple worm, present in almost all apple tree plantations, in any moment may become an economical importance pest if appropriate fight treatments are not applied. In 2008, this pest was observed on large areas (in September on 990 Ha). In June, the pest was captured on 328 Ha of 620 monitored Ha, but the flight intensity was reduced, generally. In June – July the first generation evolved. In August – September the second generation flight was more intense. In September, from 990 controlled Ha on 970 Ha the pest was observed (97.9%). Attack was weak and moderate. On infested plots, the attack was weak and moderate. Strong attack was observed on 25 Ha, and on 20 Ha the attack was very strong.

Three warning bulletins were delivered for this pest fight, and on some plots located in Reghin 5 treatments were performed according to the pattern 3 + 2, with very satisfactory results.

- *Rhagoletis cerasi*

Besides the direct damages, the cherry fly also produces indirect damages because on the attacked fruits a series of pathogen agents can easily install, *Botrytis spp.* , especially.

In June, on 72.2% of controlled area, the attack was observed. The stronger attack was observed on isolated cherry trees from gardens and yards. In July, 78 Ha were monitored and weak attacked was recorded. Even though 3 Ha were strongly attacked and 2 Ha very strong.

The picture of the *Cydia pomonella* adults captured with sexual attractant pheromone ATRAPOM is presented (table 3).

During July – September, the 473 pheromone traps captured 6,209 adults, with an average of 13 captures per trap. We observed captures for each trap (in all 20 monitored plots).

If we analyze the situation by villages, in Beica the smallest pest population was observed.

Table 3

The picture of the capture of the *Cydia pomonella* specie with sexual attraction pheromone, in 2008

Village	The observation point	Number of traps	Number of captured butterflies	Average number of captures/trap	Maximum number of captures/trap
Ideciu de Jos	Părăul Sărat	17	281	16	28
	Bungăr de Sus	29	547	19	32
	Bungăr de Jos	32	258	8	15
	Între sate	32	709	22	37
	Grădina Ilarie	15	354	24	32
Solovastru	Costişă	18	447	25	31
	Pietricica	27	637	23	31
	Gureţe	22	422	19	30
	Obrejuţă	25	86	3	9
	La moară	17	198	12	18
Gurghiu	Adrian	28	94	3	12
	Glăjărie	25	267	13	20
	Chinceş	14	261	19	25
	Mociar	14	213	15	18
	Pe faţă	20	804	40	50
Beica	Arşiţa	26	141	5	8
	Măgura	28	65	2	7
	Reghetanca	27	81	3	7
Suseni	Luieriu	30	128	10	13
	Pe luncă	27	216	8	19
TOTAL		473	6209	13	50

A positive strong correlation (0.9337), statistically very significant (22.10 $e^{0.00001}$; $p< 0.001$) was recorded between the average number of captured butterflies (310.45) and average number of captures by trap (22.10), when *Cydia pomonella* specie was monitored (figure 2).

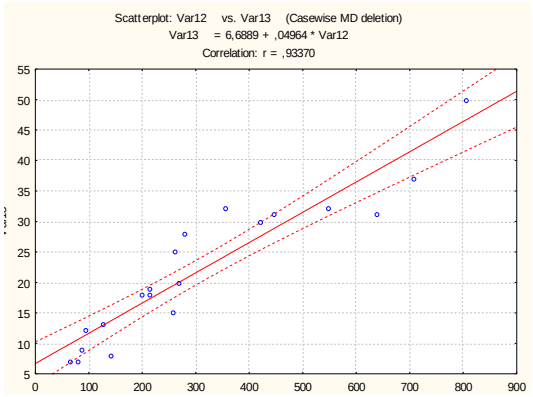

Figure 2. The correlation between the average number of captured butterflies and average number of captures/trap, when *Cydia pomonella* specie was monitored

The average number of butterflies/trap was on double folds in plantations from Măgura plots and on five folds from Arşiţa plot. Even the maximum number of captures/trap recorded in this village was the smallest (7 captures in Măgura and Reghetanca and 8 exemplars in Arşiţa). A numerically more reduced population was observed in Suseni village,

with an average of 8 captures per trap in Pe luncă plot and 10 captures per trap in Luieriu plot. Within Gurghiu village the situation differs from one point from another. If in Adrian point an average of 3 captures per trap was recorded, in Pe față point, an average of 40 captures per trap was observed. In the same village, the biggest number of captures/trap was recorded, with 50 captures by trap. In Ideciu de Jos and Solovăstru villages, relatively similar situations were recorded, and populations differ a lot from an observation point to another (from 3 to 25 captures).

CONCLUSIONS

1. The very accurate evaluation of the biological supply of all pests from plantation and monitoring their biological cycle is imposed in order to deliver warnings for appropriate chemical treatment administration

2. In tree pools, the biological supply of pests is continuously increasing due to some areas where the phytosanitary actions were suppressed.

3. In last years, within apple and pear tree plantation the apparition of the *Janus compressus* and in plum tree plantations the *Eurytoma schreiner* wasps were observed.

4. Because these two pests have very insidious attack symptomatology, the appropriate training is compulsory for specialists within phytosanitary network and for farmers, warning actions, concerning the presentation of possible harmful effects that they can produce must be performed.

5. San Jose scale, *Quadraspidiotus perniciosus*, phytosanitary quarantine specie, is encountered in over 80% of plantations, and the biological supply is preserved on the marginal rows or in hardly accessible points for chemical treatments devices.

6. The plantations from the former Inter-Corporatist, which are owned by many private farmers, presently, are real focus where the entire complex of diseases and pests is naturally developing, being a continuous source of infestation for the plantations from the area.

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