

# INTEGRATED CONTROL OF DAMAGES AND DISEASES WITHIN THE FOREST ECOSYSTEM "MIERCUREA SIBIULUI" (SIBIU, ROMANIA) IN THE CONDITIONS OF THE YEAR 2019

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**Abstract:** Out of the area of 14,911 ha, which represents the „Miercurea Sibiului” forest ecosystem, during the year 2019, an area of 2970.4 ha was affected by pests (biotics and abiotics), approximately 19.9%. From the studies carried out during the year 2019 we can mention that the infested area is maintained at the level of 2018. The forest protection measures for 2020 are necessary, timely and efficient, following the legislation in force and those recommended following the monitoring and centralization of the attack of pests and diseases. detected during the year 2019.

**Keywords:** integral control, forest ecosystem Miercurea Sibiului, biotic pests.

## INTRODUCTION

The Forest District „Miercurea Sibiului” manages a total area of 14,911 ha forest fund public property of the state, which runs from 1100 m to 1950 m, grouped in the following production units III Bistra located at over 450 m altitude, and the production units IV Ciban and V Pod situated at altitudes of over 2000 m. From an administrative point of view, the forest district comprises 3 districts with 16 forest cantons and a hunting fund. In terms of composition, in these forests the forest vegetation falls into 24 natural forest types, of which the predominant: spruce with *Vaccinium myrtillus* and *Oxalis acetosella* (m) -23%; spruce with *Vaccinium myrtillus* (i) -28%; spruce with green moss (m) -19%. Pure sprigs occupy an area of 87%, spruce-fir-beech mixtures 2%, spruce-beech 1%, mountain puree 3%, gorunete-1% and goruneto 6%. Regarding the age classes, the majority are young and middle-aged people between the ages of 1-150.

At the level of our country, over time, studies and research have been carried out on the protection of forests against diseases and pests (SIMIONESCU A., 1990; NITESCU and colab., 1992; OLENICI N., 1996; MIHALCIUC V., and colab., 2001; OLENICI N. and DUDUMAN M.L., 2016; STANCĂ-MOISE C., 2014,2016)

In the Miercurea Sibiului Forestry District in 2019, methods and means of combating pests and diseases were applied, aimed at protecting the forest ecosystem and maintaining the appropriate phytosanitary status in nurseries, solariums, young crops and deciduous and softwood trees.

Studies and research for the control and monitoring of the population of forest pests have been carried out in recent years by authors in several forest ecosystems in Sibiu County (STANCĂ-MOISE C. and BLAJ R., 2017a; STANCĂ-MOISE C. and colab., 2017b; STANCĂ-MOISE C. and colab., 2018a; STANCĂ-MOISE C. and BLAJ R., 2018b; STANCĂ-MOISE C. and colab., 2018c; STANCĂ-MOISE C., 2019; STANCĂ-MOISE C., 2020).

## MATERIALS AND METHODS

### The main pests of the forest vegetation, within the forest ecosystem „Miercurea Sibiului”

The action of the harmful agents on the Miercurea Sibiului forest ecosystem was due to both biotic pests (insects, plant pests and rodent mammals) and abiotics (wind and snow, frosts, drought, floods, hail, torrential rains, landslides). This depended largely on the structure and composition of the trees, especially on the evolution and intensity of the climatic factors that subsequently favored the attack and the development of some outbreaks of pests. As an example, the wind and snow by felling and breaking down the trees damaged the forest, being necessary to exploit them before the weather, and in specific situations they favored the propagation and extension of some species of harmful insects.

In 2019, in the nurseries within the Miercurea Sibiului forest ecosystem for the detection of biotic pests, surveys were carried out by taking and analyzing soil samples, in order to determine the degree of soil infestation, respectively the control and monitoring of the seedlings planted in order to establish the surfaces to be treated. The intensity of the infestation following the analyzes carried out in 2019 in the nurseries could establish the degree of attack, this being a very weak one in the middle.

**The plant parasite** kept under monitoring was *Fusarium sp.* on a surface of 1.6 ha in crops for which two preventive treatments were made in the spring of 2019 with Topsin M70 products with a dose of 0.2% (200 g/10 liters of water), good efficiency and Folpan 80 WDG with a dose of 1.5 Kg per ha in 1000 liters of water obtaining good results and as an alternative method was treated the germ bed with garlic juice but the efficiency was less good.

Scratching mammals attacked an area of 0.4 ha. A significant proportion of the harmful factors within the „Miercurea Sibiului” forest ecosystem are insects 42.0%, which follows 58% after the wind and snow.

In the resin species, the defoliator *Lymantria monacha*, was also monitored during the year 2019, according to Order no. 42/13.03.1987 in the forests

where spruce and fir participate over 30% regardless of the age of the tree (Fig.1).



Fig. 1. The Forest District Miercurea Sibiului map.

## RESULTS AND DISCUSSION

The researchers conducted in 2019 in order to control the populations of the *Lymantria monacha* L. defoliator, 1758 (Table 1). A total of 81 control points was mounted using Atralymon pheromone traps mounted on plastic panel (Fig. 2) races with adhesives (glues omitted) produced by the "Raluca Ripan"

Institute of Chemistry in Cluj-Napoca. In order to cover the entire area of the detour where the attacked areas were reported, the pheromone runs were placed in a monitoring system (1: 20.000) so that at about 200 ha it would be a control point. In 2019, several 2.011 samples were captured in the three production units within the „Miercurea Sibiului” forest ecosystem.

**Table 1**

Control of butterfly populations by *Lymantria monacha* L., 1758, in 2019

Forest district	Surface (ha)	Installed panels	Captured butterflies
III Bistra	4300	29	872
IV Ciban	2400	29	724
V Pode	2000	23	415
<b>Total</b>			<b>2011</b>

In order to prevent the formation of harmful outbreaks of beetles in the studied ecosystem, the broken, felled trees have been valued, tendered and taken out within the deadlines provided in the exploitation authorizations in compliance with the forest rules.

To reduce the attack produced by *Ips typographus* in the affected areas, several pheromone traps (750 Atralymon nets and 250 Atrachalc nets) were used, which were placed at 52 barrier-type pheromone races with very good efficiency (Fig. 3). The 520 pheromone races equated to 2,600 classic race aromas.



**Fig. 2.** Pheromone traps for the control of pest populations *Lymantria monacha* L (orig.)



**Fig. 3.** Pheromone traps for the control of pest populations *Ips typographus* (orig.)

**Table 2**

Population control of the *Hylobius abietis* pest within the „Miercurea Sibiului” forest ecosystem

Year	Surface (ha)	Infested surface
2010	102.60	42
2011	165.04	144
2012	133.58	84.45
2013	134.11	79.67
2014	94.11	59.88
2015	121.62	90.58
2016	119.44	103.35
2017	138	138
2018	86	86
2019	127	98
<b>Total</b>	<b>1221.5</b>	<b>925.93</b>

*Hylobius abietis* species monitoring and control methods have been proposed by various researchers from our country (OLENICI N. and OLENICI V., 2002; OLENICI N. and OLENICI V., 2006), who have conducted studies in different forest areas, where they have tested the effectiveness of different insecticides, with effect on mortality and fertility of *H. abietis* cockroaches (OLENICI N. and OLENICI V., 1994). The current situation of the surface infested with this pest is presented in (Table 4). From the analysis of the data from the table 2 which are studies conducted between 2010-2019 (Table2), it can be observed that the area under attack by *H. abietis* is 925.93 ha.

In 2019 it was treated preventively against the larvae of *Melolontha melolontha*, with Actra 25WG with a consumption norm of 2.5 Kg/ha, an area of 1.60 ha, which was found to be very effective in the

nurseries in the „Colonie” and the „Căzile” (Table 3). For 2020, agrotechnical works have been proposed by showing the soil this operation, leading to the reduction of the soil pests complex, treating the seeds before planting with garlic juice, thus avoiding combating with synthetic products obtained by chemical means and replacing them with biological methods.

For the control of the *Grylotalpa grylotalpa*, the intensity of the infestation is set from very low to medium. In order to combat this pest in 2019, Mospilan 20 SP was used with a consumption norm of 0.4 Kg per ha, the substance and the consumption norm used being 0.3 ha, finding a good efficiency and as an alternative method. I show the soil in soils kept in the black ogre. In the nurseries during the winter, traps were used with fresh manure, the method was used in previous years with very good results.

**Table 3**

Pest situation and dynamics of active outbreaks in trees and nurseries within the „Miercurea Sibiului” Forestry District in 2019

The place where the damage was reported					Infested surface		The intensity of the infestation	
Nursery	Culture Surface	Species within culture	Age	Pest/disease or abiotic factor	In the previous year 2018	Year of 2019	In the previous year 2018	Year of 2019
Colonie	0.71	8MO2LA	1-3	<i>Melolonta melolontah</i>	0.32	0.77	FS	FS
Căzile	1.02	10MO	1-3	<i>Melolonta melolontah</i>	0.45	0.80	FS	FS
Miercurea	0.02				0.03	0.03	FS	FS
<b>Total</b>	<b>1.75</b>				<b>0.80</b>	<b>1.60</b>		
Colonie	0.71	10MO	1-3	<i>Grylotalpa grylotalpa</i>	0.8	0.18	FS	FS
Căzile	1.02	10MO	1-3	<i>Grylotalpa grylotalpa</i>	0.20	0.20	FS	FS
Miercurea	0.02	10MO	1-3	<i>Grylotalpa grylotalpa</i>	0.02	0.02	FS	FS
<b>Total</b>	<b>1.75</b>				<b>0.20</b>	<b>0.40</b>		
Colonie	0.71	10MO	1-2	<i>Fuzarium sp.</i>	0.40	0.50	FS	FS
Căzile	1.02	10MO	1-2	<i>Fuzarium sp.</i>	0.70	1.00	FS	FS
Miercurea	0.02	10MO	1	<i>Fuzarium sp.</i>	0.10	0.10	FS	FS
<b>Total</b>	<b>1.75</b>				<b>1.20</b>	<b>1.60</b>		
Colonie	0.71	8MO1LA1BR	1-3	Rats	0.10	0.20	FS	FS
Căzile	1.02	10MO	1+3	Moles	0.18	0.18	FS	FS
Miercurea	0.02	10MO	1	Moles	0.02	0.02	FS	FS
<b>Total</b>	<b>1.75</b>				<b>0.30</b>	<b>0.40</b>		
Colonie	0.71	9MO1LA	1--3	Drought	0.20	0.20	SM	S
Căzile	1.02	8MO1LA1BR	1--3	Drought	0.20	0.20	SM	S
Miercurea	0.02	10MO	1--2	Drought				
<b>Total</b>	<b>1.75</b>				<b>0.40</b>	<b>0.40</b>		

**Table 4**

The situation of pests and the dynamics of the active outbreaks in the three production units within the „Miercurea Sibiului” Forestry District in 2019

The place where the damage was reported					Infested surface		The intensity of the infestation	
Nursery	Culture Surface	Species within culture	Age	Pest / disease or abiotic factor	In the previous year 2018	Year of 2019	In the previous year 2018	Year of 2019
III Bistra	75.5	10MO	1--5	<i>Hylobius abietis</i>	20.0	22.0	FS	FS-M
IVCiban	181.5	10MO	1--5	<i>Hylobius abietis</i>	23.0	27.0	FS	FS-M
V Pode	219	10MO	1--5	<i>Hylobius abietis</i>	43.0	39.0	FS	FS-M
<b>Total</b>	<b>476</b>				<b>86</b>	<b>88</b>		
III Bistra	75.5	10MO	1--5	<i>Hylastes sp.</i>	3	2	FS	FS
IVCiban	181.5	10MO	1--5	<i>Hylastes sp.</i>	3	3	FS	FS
V Pode	219	10MO	1--5	<i>Hylastes sp.</i>	4	4	FS	FS
<b>Total</b>					<b>10</b>	<b>9</b>		
III Bistra	2000	10MO	60-130	<i>Ips typographus</i>	868	731	M-P	M-P
IVCiban	2680	10MO	60-130	<i>Ips typographus</i>	663	735	M-P	M-P
V Pode	2000	10MO	60-130	<i>Ips typographus</i>	514	559	M-P	M-P
<b>Total</b>					<b>2045</b>	<b>2025</b>		
IVCiban	310	10MO	60-130	<i>Trypodendron lineatus</i>	20	20	S	S
<b>Total</b>	<b>310</b>				<b>20</b>	<b>20</b>		
III Bistra	75	10MO	10--30	<i>Chermes viridis</i>	5	5	FS	FS
IVCiban	160	10MO	10--30	<i>Chermes viridis</i>	7	7	FS	FS
V Pode	185	10MO	10--30	<i>Chermes viridis</i>	0	0	FS	FS
<b>Total</b>	<b>420</b>				<b>12</b>	<b>12</b>		
III Bistra	75.5	8MO1BR1LA	5--20	Cervidae	1	2	FS	FS
IVCiban	181.5	10MO	5--20	Cervidae	6	5	FS	FS
V Pode	219	10MO	5--20	Cervidae	5	10	FS	FS
<b>Total</b>	<b>476</b>				<b>12</b>	<b>17</b>		
III Bistra	35.5	10MO	5--20	Rats	10	10	FS	FS
IVCiban	130	10MO	5--20	Rats	10	10	FS	FS
V Pode	82.5	10MO	5--20	Rats	10	10	FS	FS
<b>Total</b>	<b>247.8</b>				<b>30</b>	<b>30</b>		

III Bistra	800	10MO	15-130	Wind	85	135	S-M	S-M
IVCiban	1200	10MO	15-130	Wind	64	139	S-M	S-M
V Pode	800	10MO	15-130	Wind	181	52	S-M	S-M
<b>Total</b>	<b>2800</b>				<b>330</b>	<b>326</b>		
III Bistra	3200	10MO	15-130	Drying	150	150	FS	FS
IVCiban	4300	10MO	15-130	Drying	160	160	FS	FS
V Pode	3300	10MO	15-130	Drying	120	120	FS	FS
<b>Total</b>	<b>10800</b>				<b>430</b>	<b>430</b>		

For 2020, at the level of the studied forest ecosystem, it will be used as a method of control against the *Melolontha melolontha* larvae by the more insecticide Actra 25 WG with a consul norm of 2.5 Kg/ha.

For the year 2020 in order to reduce the attack of *Fuzarium sp.* two preventive treatments were proposed on a surface of 1.6 ha, the intensity of the infestation being from very low to medium, with Vandozeb products with a dose of 0.2 (20g/10 liters of water) and Folpan 80 WDG with a dose 1.5 Kg per ha 1000 l of water, in all soils where new crops of spruce or larch seeds will be established as well as in crops of spruce sprouts, predisposed to the attack of this disease. As an alternative method, the germination bed was treated as in previous years with garlic juice.

In order to limit the attack of rodent mammals, the area that is expected to be fought in 2020 against them will be 0.40 ha, using mechanical traps and enclosing solariums and crops in nurseries (Miercurea, Colony and Houses) with shock branches. which are repellent to pests.

Following the centralization of the catches of the *Lymantria monacha* defoliator in 2019, the highest number of butterflies at a control point during the entire observation period were recorded in the production unit III Bistra, in the administrative unit 162 B, where 64 butterflies were captured.

Considering the intensity of the attack reported in 2019, for 2020, it was recommended to postpone a number of 527 wing-type races in the areas where dry and drying shafts were detected, which is equivalent to 2635 classic race trees. For the year 2020, 1000 pheromone nets were recommended, of which 750 pieces AtraTyp and 250 pieces AtraChalc.

In 2019, *Hylobius abietis* was reported on 88 hectares in the production units where the resin species predominate. The infestations ranged from very weak to medium, to combat this pest were used during the vegetation season between 60 and 160 toxic bark, but also chemically treated with Mospilan 20 Sp, with a consumption norm of 0.2 kg/1000 pieces.

In the areas already planted in previous years, toxic bark was placed at the end of May. The results were good, finding a maximum percentage of 10% seedlings attacked superficially in the season of vegetation by pinching without noticing major losses.

At the plantations that were carried out in the spring of 2019, depending on the estimation of the risk of attack of each surface, they were placed with the planting of toxic seedlings and bark depending on the intensity of the attack. Also, to protect the seedlings, they were bathed before planting in a Mospilan 20 Sp 0.5% emulsion using 50 g per 1000 resin seedlings

(spruce, larch). This treatment ensured the protection of the seedlings for a period of approximately one month, with very good results in the plantations carried out after the rest of two years after the exploitation of the tree.

## CONCLUSIONS

Pest *Lymantria monacha* is still in the latency stage because no more than 200 butterflies were captured at a control point in trees under 60 years old or over 500 butterflies at a control point in trees over 60 years old.

In order to stimulate the propagation of insectivorous birds in the Forest Miercurea Sibiului range, artificial nests of insectivorous birds have been placed in the forest fund, because by the action of sanitation of the forest, some of the natural shelters have been destroyed. Every year these artificial nests will be repaired and cleaned by the nests. Also, in 2019, several 30 ant ants were identified as compared to 22 in 2018, the concern being their multiplication because it constitutes a trophic base for insectivorous birds.

To treat the 322 seedlings planted in the year 322 seedlings in 2019 was used Mospilan 20 Sp emulsion, 0.5%. An estimated 15 Kg insecticide will be used to treat the 296 thousand seedlings to be planted in the spring of 2020, respectively 3 Kg for treating toxic bark.

The need to know the phytosanitary status of forests and crops within the „Miercurea Sibiului” Forestry District, as well as the measures to be taken to maintain an adequate phytosanitary status, led to the completion of this study. Taking timely all the necessary measures regarding the works of protection of the forest fund leads to the diminution of the losses produced as a result of the attack of the pests, losses materialized either by losses of growth or, and more serious by the drying of the trees.

In the case of the three nurseries (Miercurea, Cădile and Colonia) the works must have a preventive character, their purpose being to maintain a good phytosanitary status and to avoid losses.

In the softwood trees the exploitation of the attacked timber is aimed at avoiding the depreciation of the attacked timber and drying on the foot. Maintaining it would lead to impairment and consequently to loss of value.

The Forest Mole "Miercurea Sibiului" through the technical and experimental assistance works of the INCDS "Marin Drăcea" the researches and the studies carried out aim to find alternative methods for chemical pest control.

Permanent monitoring of ants' burrows in the radius of the by-pass leads to maintaining a high level of the

population of insectivorous birds, both by maintaining artificial nests placed in the forest and by maintaining the trees with natural trees.

### AUTHORS CONTRIBUTIONS

Conceptualization: C. Stancă-Moise; R. Blaj;  
Methodology: C. Stancă-Moise; Data collection: C. Stancă-Moise; R. Blaj; Data validation: C. Stancă-Moise; R. Blaj; Data processing: C. Stancă-Moise; R. Blaj —original draft preparation: C. Stancă-Moise; R. Blaj —review and editing: C. Stancă-Moise; R. Blaj.

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### CONFLICT OF INTEREST

The authors declare no conflict of interest.

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