

RESEARCH ON THE DEVELOPMENT OF STEM AND BARK DANGERS BETWEEN THE PERIOD OF 2016-2018 IN THE RĂȘINARI SILVIC RANGE FOREST, SIBIU COUNTY

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Abstract. The pests of the stem and bark of resinous species were also reported in the Rășinari Forestry. Monitoring the pests after confirming their presence in different areas of the forest fund, the observations related to the different stages of development and the study were made according to the characteristic of the damage. Adult observation was signaled during the flight, traveling from one place to another, in search of a hole to jump into the bark of tree trunks. During the period 2016-2018, in the Rășinari Forestry, weak insect attacks were observed, in particular: *Ips typographus*, *Hylobius abietis* and *Tortrix viridata*. The degree of infestation is poor, with prophylactic and effective combat.

Keywords: Rășinari Forestry, monitoring, pests, *Ips typographus*, *Hylobius abietis* and *Tortrix viridata*.

Rezumat. Cercetări asupra evoluției dăunătorilor de tulpină și scoarță în perioada anilor 2016-2018, în cadrul Ocolului Silvic Rășinari, județul Sibiu. Dăunătorii tulpinii și cei de scoarță ai speciilor de rășinoase au fost semnalati și în cadrul Ocolului Silvic Rășinari. Monitorizarea dăunătorilor după confirmarea prezenței lor în diferite zone ale fondului forestier, observațiile legate de diferite stadii de dezvoltare și realizarea studiului s-au făcut după caracteristica vătămării. Observarea adulților a fost semnalată în timpul zborului, în deplasările de la un loc la altul, în căutarea roaderii unui orificiului pentru a intra în scoarță de pe trunchiurile arborilor. În perioada anilor 2016-2018 în cadrul Ocolului Silvic Rășinari s-au observat, atacuri slabe de insecte, în special: *Ips typographus*, *Hylobius abietis* și *Tortrix viridata*. Gradul de infestare este slab, procedându-se la o combatere profilactică eficientă.

Cuvinte cheie: Ocolul Silvic Rășinari, monitorizare, dăunători, *Ips typographus*, *Hylobius abietis* și *Tortrix viridata*.

INTRODUCTION

From a geographic point of view, the territory on which the forests of Rășinari are situated is located in the mountain area (85%) and the hill (15%), in the middle basin of the Sadu river on the left slope of the Sadul Valley and the North-East of the Mountains Cibin, on the right side of the Steaza Valley. Forests are located at an altitude between 400 m (U.B. VI) and 1900 m (U.P.V), and the general exhibition is partially sunny (46%). The most common type of mountain resort is: 2332 - Bm spruce hillsides, Oxalis-Dentaria (33%), and the prevalent forest type is 1121-Molidis with green Bm mussels (22%). The direct neighborhoods of the forest are lands with public forest ownership of the state or private public property and agricultural land with different uses (arable, hayfields, pastures) (SCHNEIDER-BINDER, 1973).

The forest vegetation that does not belong to the Forestry of Rășinari is made up of clusters of trees or wooded pastures. For this form of vegetation, specialized studies (silvic-pastoral arrangements) have been prepared. The species that form grassland and wooded pastures are spruce, beech and birch. Geomorphological factors are important by influencing ecological factors, heat, light, humidity. Their variety determines the variety of forest resorts, and the altitude difference leads to vegetation distribution; so, in the hills we encounter beech-oaks and even anis, and on the slopes of the mountains we find spruce forests, beech forests and mixtures with oak and other species. The forest formations consisted of a structure of five basic species (spruce, fir, beech and oak) the highest share being 58% of the spruce, which shows that the spruce is in the area. The remaining basic formations were formed on beech and the oak. Oak species have a symbolic presence (SCHNEIDER-BINDER, 1973).

In the forests of the Rășinari commune there is a rich hydrological network whose main collectors are the Sadu River and Steaza Valley. Part of the stream and the gorges feed the Aries Lake. It can be said that the forest vegetation takes the necessary water for the development almost entirely from precipitations. The studied territory is in the moderate, boreal continental climate, the mountain climate, corresponding to the high area with cool winters, precipitation throughout the year, with the coldest temperature below 5°C and the warmest below 18°C.

In the Forest of Dumbrava Sibiului (BUCȘA & CURTEAN, 1996; BUCȘA, 1997, 2002, 2004), in the Forest Range Miercurea Sibiului (STANCĂ-MOISE & BLAJ, 2017a; STANCĂ-MOISE et al., 2017b), Rășinari Forestry ecosystem (ANTONIE, 2015) and in the Forest District Sibiu (STANCĂ-MOISE et al., 2018a; STANCĂ-MOISE & BLAJ, 2018b; STANCĂ-MOISE et al., 2018c), studies on affected forests were carried out (STANCĂ-MOISE, 2014; 2016).

MATERIALS AND METHOD

In limiting the populations of the *Ips typographus* pest within the Rășinari Forestry Plant in the three production units (Oncești UPV, Rășinari UPVI and UPUNI UPVI Forest Hills), the pheromone method of attracting and catching adults was used. Flight barriers that were placed on the sunny slopes were used at a distance of about 10-20 m from the tree and about 25 m away between two adjacent trees. Pheasant lures with trappings were placed 2-3

times a week to remove captured adults who might otherwise have been decomposed and would have considerably reduced the effectiveness of the pheromone. The races were primed with the *Atratyp Plus* pheromone produced at the Raluca Ripan Institute of Chemistry in Cluj (Fig. 1), where the races were also made, the pheromone proving to be comparable in terms of the efficiency of catching beetles with those produced abroad (MIHALCIUC et al., 1998; MIHALCIUC et al., 2001; LUBOJACKÝ J. & HOLUSA, 2014).

In order to limit *Hylobius abietis* populations during the years 2016-2018, pheromone barriers were placed, consisting of a panel made of foil (DILLON et al., 2006), under which the adult collecting trough was mounted. The panel had the following dimensions 50/50 cm, and the collecting trough was 50-60 cm long, width 20-30 cm and height 15-20 cm. There was a constant water level (about half the volume) in this trough (DAY SR. & SALISBURY, 1999; HERITAGE S. & MOORE, 2001; DILLON et al., 2008).



Figure 1. Barrier pheromone races (orig. photo.)

In limiting the populations of the *Tortrix viridata* pest in the Rășinari Forest, ATRAVIR fertilizers were used, with the pheromone composition: Z11-tetradecen-1-yl acetate (sexual attractant). Pheromone balls placed in the center of vertical panels with adhesive were fixed to the shafts. The number of catches in the period 2016-2018 also allowed a prognosis on the evolution of population in 2019.

Catch points of the pests: *Ips typographus*, *Hylobius abietis* and *Tortrix viridata* in the Rășinari Forest were located in areas affected by wind or snow by knots and ruptures, packages in operation up to 3-4 years old with damaged trees, physiologically weakened stands, resins, damaged by wind, watered, polluted, affected forests where a significant proportion of defoliators were found. The placement of these races was done in the slopes, in the clearings and in the forest meshes, at a distance of 10-30 m from the edge of the forest. They were installed before the beginning of the insects' flight (end of March/early April). The collection points covered the entire surveyed surface, perimeter, altitude and exhibition area.

RESULTS AND DISCUSSIONS

Ips typographus (Coleoptera: Curculionidae) (Great bark beetle of spruce). This pest was reported in the Forestry District of Rășinari between 2016-2018 (Tables 1, 2, 3) in the spruce forest, but also mixed with other whitewood species. The infestation rate in the year 2016 was 496 hectares, and 169 Atratyp Plus pheromone races were used to fight this pest. In 2017 the degree of satisfaction was 343 hectares, using 163 pheromone races to limit the population of this pest. There is a regression in the evolution of the pest in 2018, the infested area being 343 hectares, fighting against a number of 133 traps. The infested trees were aged between 5-120 years old and were attacked by larvae making their galleries, and the attack of this pest among the young trees was rarely identified.

Under the conditions of the forest ecosystem within the Silviculture of Rășinari, 2 generations per year were reported, and the adults were detected by wintering in the stem of the infested trees. It is also found that there are cases when the pest grows in the egg, larvae or adult. The finding of the attack was made with the naked eye, based on the green-gray-pale appearance of the infested trees. Over time, the coloration changed to yellow, red and finally the trees dried out. The color change began from the top of the tree to the base. When the attack was set up, the bark was exfoliated starting from the middle of the trunk and advancing up and down, 2-3 months after the appearance of the adults.

Table 1. The pest attack of *Ips typographus* within the Rășinari Forestry, 2016.

No. Criterion	UP Bazinet	Ua /Groups of u.a.	The surface of whitewood stands		Population Density Nr. holes / m2	Infected trees in the category		Nr. of trees needed for the category		TREES (pc.)			Necessary snares		Pheromonal lures
			Total	Infested		I	II	I	II	Snare (I+II)	Control	Total (11+12)	Wing type traps, x5	Primed and treated trees + x3	
1	Oncești UP V	1-141	4320	446	until 8	50	50	17	50	67	22	89	112	22	134
2	Rășinari UP VI	17-124	1078	50	until 8	0	0	0	0	0	0	0	25	0	25
3	Pasture imp. UP VII	19-76	585	0	-	0	0	0	0	0	0	0	10	0	10
TOTAL			5983	496		50	50	17	50	67	22	89	147	22	169

Table 2. The pest attack of *Ips typographus* within the Rășinari Forestry, 2017.

No. Crt.	UP Bazinet	Ua /Groups of u.a.	The surface of whitewood stands		Population Density Nr. holes / m2	Infected trees in the category		Nr. of trees needed for the category		TREES (pc)			Necessary snares		Pheromonal lures
			Total	Infested		I	II	I	II	Snare (I+II)	Control	Total (11+12)	Wind type traps, x5	Primed and treated trees x3	
1	Oncești UP V	1-141	4320	271	until 8	66	66	14	66	80	27	107	90	27	117
2	Rășinari UP VI	17-124	1078	72	until 8	0	0	0	0	0	0	0	36	0	36
3	Pasture imp. UP VII	19-76	585	0	-	0	0	0	0	0	0	0	10	0	10
TOTAL			5983	343		66	66	14	66	80	27	107	136	27	163

Hylobius abietis (Coleoptera: Curculionidae) was monitored in the Forestry of Rășinari during the years 2016-2018 (Tables 4, 5, 6) in the places with cutting breeds and immediate afforestation where it caused crop injuries to barely planted softwoods, especially spruce, aged 2-5 years old. In 2016 the infested area was 32.3 ha, the intensity of the attack decreased in 2017 to 7.1 ha and in 2018 to 4.6 ha.

The attack was produced by adults affecting the bark of the seedlings, a result being the leakage of resin appeared in place of the injury. The notice of this pest within the Rășinari Forestry imposed measures to protect the forest fund and control the population of this pest, which shows a decrease of the surface attacked in 2018 and a forecast of less than 3 ha in 2019.

In the favourable years, adults are active from March to October when the population can reach a density of 100,000 individuals/ha (OLENICI & OLENICI, 2002, 2003, 2006; OLENICI et al., 2007). The growth of the beetle population for 2-3 years can lead to overlapping of generations and thus a multiplication of the adult population (OLENICI et al., 2005).

Table 3. The pest attack of *Ips typographus* within Rășinari Forestry 2018.

No. Crt.	UP Bazinet	Ua /Groups of u.a.	The surface of whitewood stands		Population Density Nr. holes / m2	Infected trees in the category		Nr. of trees needed for the category		TREES (pc)			Necessary snares		Pheromonal lures
			Total	Infested		I	II	I	II	Snare (I+II)	Control	Total (11+12)	Wind type traps, x5	Primed and treated trees x3	
1	Oncești UP V	1-141	4320	289	until 8	0	0	0	0	0	0	0	96	0	96
2	Rășinari UP VI	17-124	1078	54	until 8	0	0	0	0	0	0	0	27	0	27
3	Pasture imp. UP VII	19-76	585	0	-	0	0	0	0	0	0	0	10	0	10
TOTAL			5983	343		0	0	0	0	0	0	0	133	0	133

For survival but also for reproduction, beetles from different generations feed themselves on the entire vegetation season, causing damage to the bark of the saplings. Ponta is deposited by females in the cracks of the crust, being attracted by the smell of freshly cut wood. Larvae are not important because they cause injuries in the roots of Olenici cages.

Table 4. Data statistics and the dynamics of active fuels in tree groups between 2015-2016, within the Rășinari Forestry.

FOREST					Pest, illness or the abiotic factor	Infested surface in the year of :		Infested surface in the year of :	
Naming	Ua/ Groups of ua/	Surface/ ha	Composition	Age (years)		2015	2016	2015	2016
Rășinari UP VI	17 – 124	1077.5	min.30%MoBr	5 – 120	<i>Ips typographus</i>	2	50	S	fs
TOTAL		5397.9				19	496		
Rășinari UP VI	1 – 126	497.2	min.30%GoSt	5 – 150	<i>Tortrix viridana</i>	-	-	Latency	Latency
UP V, VI,VII		87.7	9Mo1Br(La)	1 – 4	<i>Hylobius abietis</i>	0.2	32.4	s	s

Table 5. Data statistics and the dynamics of active fuels in tree groups between 2016-2017, within the Rășinari Forestry.

FOREST					Pest, illness or the abiotic factor	Infested surface in the year of :		Infested surface in the year of :	
Naming	Ua/ groups of ua/	Surface ha	Composition	Age (years)		2016	2017	2016	2017
Rășinari UP VI	17 – 124	1077.5	min.30%MoBr	5 – 120	<i>Ips typographus</i>	50	72	fs	fs
TOTAL		5397.9				496	343		
Rășinari UP VI	1 – 126	497.2	min.30%GoSt	5 – 150	<i>Tortrix viridana</i>	-	-	latency	latency
UP V, VI,VII		87.7	9Mo1Br(La)	1 – 4	<i>Hylobius abietis</i>	32.4	7.1	s	s

Table 6. Data statistics and the dynamics of active fuels in tree groups between 2017-2018, within the Rășinari Forestry.

FOREST					Pest, illness or the abiotic factor	Infested surface in the year of : ha		Infested surface in the year of : ha	
Naming	Ua/ Groups of ua/	Surface ha	Composition	Age (years)		2017	2018	2017	2018
Oncești UP V	1 -141	4320.4	min.30%MoBr	5 – 120	<i>Ips typographus</i>	271	289	fs	fs
Rășinari UP VI	17 – 124	1077.5	min.30%MoBr	5 – 120	<i>Ips typographus</i>	72	54	fs	fs
TOTAL		5397.9				343	343		
Rășinari UP VI	1 – 126	497.2	min.30%GoSt	5 – 150	<i>Tortrix viridana</i>	-	-	latency	latency
UP V, VI,VII		87.7	9Mo1Br(La)	1 – 4	<i>Hylobius abietis</i>	7.1	4.6	s	s

Abbreviations: Mo - spruce; Br - Fir; La-larch; Go- sessile Oak; Sr - Oak tree; Fs - very weak attack (1-10%); S- weak attack (11-25%); M- middle attack (26- 50%).

Tortrix viridana is a pest that attacks oak, hornbeam, elm and birch but also fruit trees. The butterfly has a wingspan of 18-25 mm. The front wings are of light green uniform, larger than the hindmost grey ones. Females deposit eggs that are small, yellow-orange, two on the thin branches at the base of the petiole, the buds, and on the top of the crown (GOOSHBOR et al., 2016). In spring, early April, small, black-eyed larvae appear to be tied to silky yarns that attack the buds, and later young leaves. It has reached full development (18 mm in length), in June it shoots in twisted leaves, and after 2-3 weeks, at the end of June, begins the flight of adults, above the crowns. Larva attack reduces growth, predisposing trees (trees) to attack other pests. In the Rășinari Forest Area (Tables 4, 5, 6) the attack of this pest is considered to be latent.

CONCLUSIONS

During the years 2016-2018, within the Silviculture Forestry of Rășinari, a collection of 495 pheromone flights served an area of 1182 ha of forest affected by the *Ips typographus* pest attack presented in Tables 1, 2, 3. Following the synthesis and the interpretation and analysis of the catches we found the following: the largest attacked forest area of 446 hectares was in the production unit from Oncești UPV, followed by Rășinari UP VI 50 ha, which can be said that the degree of infestation is a weak one. As a result of flocking, *Ips typographus* populations had a large amount of wood material favourable to feeding and reproduction.

Pheromone trapping levels remained relatively constant in 2018 compared to 2017 during the vegetation season, indicating moderate densities of bark beetle populations within the Silviculture Forestry of Rășinari. The localized outbreaks were predominantly damaged due to the poor vegetation state of trees suddenly exposed to direct sunlight, which favoured the installation of bark beetles. As a result of the research we found that the capture was conditioned by the general flight evolution, by the climatic factors of each year and by the location of the trap. Differences noted from one point to another were due to the local conditions of each collection area.

In order to prevent the formation of outbreaks of *Ipidae* in the Silviculture Forestry of Rășinari, hygienic measures are recommended, broken and demolished trees should be removed to avoid the occurrence of outbreaks.

The attack of *Hylobius abietis* bark pests during 2016-2018 within the Silviculture Forestry of Rășinari was on an area of 44 ha, 32.3 ha attacked in 2017, 7.1 ha in 2018 and a 4.6 ha in 2019. Following monitoring to control the populations of bark pests *Hylobius abietis*, it was observed that infestations ranged from very weak to latent. To avoid the attack of this pest, we propose treating the seedlings with Mospilan before planting.

Tortrix viridana was monitored during the Rally between 2016 and 2018 but its presence was not reported, considering it was in a state of latency.

In the future, in the Rășinari Forestry, the populations of *Ips typographus*, *Hylobius abietis* and *Tortrix viridana* pests are kept under observation, and where their presence is reported, measures are taken to combat and control populations.

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Received: March 29, 2019
Accepted: June 21, 2019