Ips thypographus (COLEOPTERA, SCOLYTIDAE) AT "OCOLUL SILVIC MIERCUREA SIBIULUI" (SIBIU COUNTY, ROMANIA)

Cristina STANCĂ-MOISE*, Robert BLAJ*

*"Lucian Blaga" University of Sibiu, Faculty of Agricultural Sciences, Food Industry and Environmental Protection, Sibiu, Romania
Corresponding author: Cristina Moise, "Lucian Blaga" University of Sibiu, Faculty of Agricultural Sciences, Food Industry and Environmental Protection, 5-7 Ion Ratiu, 550371 Sibiu, Romania, phone: 0040269234111, fax: 0040269234111, e-mail: cristinamoise1@yahoo.com

Abstract. *Ips thypographus* is known as one of the most species that produces important pest of the spruce fir forest. In the conditions of overpopulation, this pest could become an important one and in this case they are endangered also the healthy trees and it is necessary to apply the urgent and expensive protection measures.

The successful prevention measures about the appearance of the infestation centers (points, focus), the prevention of the exceeding the economical point (threshold, on the brink) of the pest are in connection with a thoroughgoing study of the pest biolgy and with the perfecting the methods and the means of the monitoring, prognosis and at the end of the preventive control of the pest.

For these reasons, they were made numerous studies and researches concerning the knowledge of the species *Ips thypographus* by some researchers. Because the development of this pest is in connection with many factors, among them, the climatical ones have a prevalent role, the detailed studies in the concrete conditions are imperatively necessary. The generalizations of some particular cases are irelevant. In this paper we propose ourselves to study the species. *Ips thypographus* in the particular conditions from the "Ocolul Silvic Miercurea Sibiului", (Sibiu county, Romania) between the years 2015-2016.

Keywords: monitoring, protection methods, pheromonale traps, *Ips thypographus*.

INTRODUCTION

The forest protections has as its purpose to prevent the attacks produced by diseases and pests and their control [39], in the frame on the whole measures of the rational management and lasting administration of the national forestry fond, according to the principles acceptated (agreed) at the European and World level [11-13, 18-20, 35-38]. These principles converge to obtain the maximum economical profits without to neglect any moment the ecological equilibrium that the forest has to generate and to maintain itself [1-9, 16, 17, 27].

The knowledge of the bark beetles (Family Ipidae, Coleoptera) their bioecology and the phytopathogenous factors, is the basis of the elaboration of the most efficient control meeasures required in the calamity cases. About these phenomenons, abiotic factors are very important and they act indirectly. So the excessive droughts contribute to the physiological debility of the trees and creates the favourable condtitions to mass multiplication of ipids.

The pedoclimatic conditions of the area are characterized by the middle and upper terraces with poor soils and hydrophobic soils whose genesis is related to the presence of shallow aquifers with brown alluvial soils. The mineral substrate is predominated by gravels and sandy-skeletal deposits, which provide the natural drainage [10].

In terms of climate, the study area is located in Romania, in Sibiu County [32] in a region with sub-humid climate. The average annual precipitation is of 662 mm. The average annual temperature is about 9.4°C. The annual aridity index has a value of 35 and two of the monthly aridity indexes have the value of about 28 and only one drops below this value (in September) but without reaching the aridity limit [28, 32].

MATERIALS AND METHODS

Bark beetls from resinous forests are signaled and are found during the whole year. In order to found them, on make observations about their different development stages (phases) but also after characteristic on trees. In case of the adult, on can observe flying swarmes that move from one place to anotheer, and on the trees tranks on can identify the beetles searching a place to make an orifice to enter into the bark, or by mean of pheromonal method in order to attract and to capture the adults. Our researches were made during the years 2015-2016 and they had as a purpose the monitoring of the pest, the study of the populations dynamic, the efficiency of males captures and the way of installation of the pheromonale traps in the perimeter of the "Ocolul Silvic Miercurea Sibiului", Stat Ocol on surface of 14.932,37 ha forest. In the area were not carried out such research.

The captures obtained by mean of the traps used in the perimeter of the "Ocolul Silvic Miercurea Sibiului" in years 2015-2016 followed the population dynamic of *Ips typographus* and were made in the forests: Bistra, Ciban and Curpăr that hat 70% from their wood mass of fir and spruce fir, with the age between 50-125 years.

The capture points were placed in zones affected by felled and breaked trees by wind or snow, the parcels put into operation with an age of 3-4 years with wounded trees, or physiological weak trees, harmed by wind, in marshs (swamps), polluted, leafless forests affected by insects and also forests affected by Fungus of Genus *Fomes* and species *Armillaria mellea*.

The points were placed in a different way, in connection with their exposure, altitude, slope and it represents the total stationary and vegetation conditions in the studied zones [1-10, 14, 22-33]. They were used climatical data from Meteorological Station Sibiu [32]

data processed and interpreted by us.

Detection, collecting and monitoring of the species *Ips thypographus* were made by mean of pheromonal traps. For collecting the insects they were used pheromonal traps barrier type with pheromonal baits Atratyp Plus type (Foto 1A).

The were used baits Atratyp type (Foto1A) produced by Institute of Chemical Research "Raluca Ripan" [39] in Cluj Napoca. The pheromonal traps were installed in skirts of the forests, glades, in the less lighted places, at 10-30 m distance of the forest limit.

In the places where we installed these traps weren't felled trees, prefered by insects, so these places shall not be an infestation source for this pest. The distance between traps was of 50-100 m till 200-300 m, depending on the density of population and the orography of the field. Many time we installed a pheromonal trap at 2-4 ha distance. The increase of the number of pheromonal traps was depending on the intensity of infestation.

The barrier type traps, are composed of a glass or plastic panel, under that on set pipe for collecting the aduls. The panel is in general of size 50/50 cm and the pipe of collecting has a length of 50-60 cm, width of 20-30 cm and hight of 15-20 cm. In this pipe there was a constant level of water (aproximate half of the volum).

The pheromonal bait are set over the glass panel or in the plastic panel. The traps on verify 2-3 times a week for remove the captured adults, that could enter into decomposition and could reduce considerably the efficiency of the pheromon (Foto 1B) [15].

To be effective, namely to have power of attraction greater than or at least equal to the natural source to preserve its ability to pull a long time (period of activity of insects bark a growing season) to ensure uniformity throughout the attraction activity.

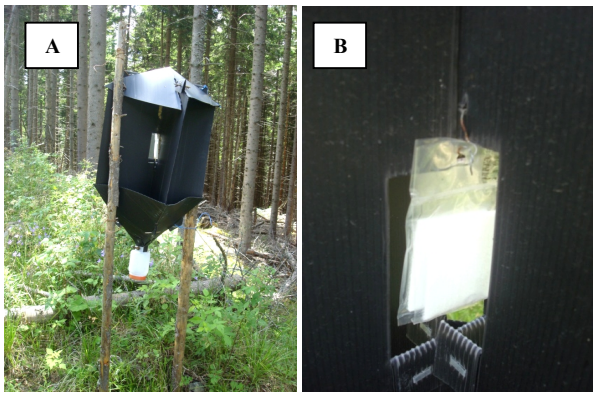

Foto 1. Pheromonal baits Atratyp Plus type (A); Beetles captured using pheromone trap (B) (orig.)

The insects were collected and registered every theree days. The traps were placed in the skirts of forest, glades, at 10-30 m distance from the forest limit. They were installed before to begin the flight of insects (the end of March-begin of April). *Ips thypographus* females oviposited successfully in the temperature range 12-33 ^{o}C [34,36].

The collecting 520 points covered the whole studied surface, from the point of view perimeteral and altitudinal.

The adults are small (4.2-5.5 mm long), cylindrical, dark-brown, shiny and hairy. The antennae are clavate. The frontal part of the pronotum is obliquely cut, dentate and squamate, and the hind part is stippled. There are rows of depressed points on the glossy elytra, with spaces in between them. The posterior edges of the elytra form a characteristic collar shape, with dents on both sides. There are four teeth on these edges and the third tooth is capitate. The rear side of the elytral declivity is greasy and shiny (when the insect is viewed from the rear) [40].

The trees were placed in the skirt zones of the forest, in the glades (the trap-trees are semi-uprooted trees or broken trees) and then, after remove of the bark by chemical treatments, in order to distroy the biological reserve of the beetles species. The intervention must be done before the adults leave the bark of the trees [13].

RESULTS

For the monitoring of the Ipidae populations, in order to establish the tendencies of populational dynamic May-September, but also for the control of the bark beetles species, they were used trap-trees. The trap-tres were selected, because they are prefered by adults species. The role of this trees is to attract the beetles population to lay down the eggs in their bark. In order to increase the capacity of attraction of the trap-trees on could proceed to amplify it with the agregative pheromon.

For the analysis of the data they were made statistical situations as a basis for interpretation of *Ips thypographus* flight during the period 2015-2016. For the established the infestation intensity by pheromonal traps we used the following estimation [21]: very weak (till 300 beetles at one trap), weak (300-750 beetles), medium (750-1500 beetles), intense (over 1500 beetles), and very intense (over 3000 beetles).

DISCUSSIONS

During the period 2015-2016 they were placed 520 points with pheromonal traps and as result were collected 5.168 samples of *Ips thypographus*. All data are presented in the Table 1, 2, 3. They were made the synthesis, interpretation and analysis of the captured material and they were drawn the following conclusions.

The most numerous samples were harvested in UP (production unit) III Bistra u.a. 171% because in this point were the most favourable conditions, surface of 2000 ha difference of level, exposure, forests mixt of spruce fir and beech with ages between 50-125 years and an early flight.

Table 1. The first stage. The resinous forest infested by Ipidae and the wood mass from the felled trees/broken by wind/snow and from centers of infestation with Ipidae, not in exploitation on 30.09.2015

Nr. crt.	U.P.	The trees from the centers of infestation with Ipidae				The surface of the infestated forests		The measures to control Ipids in 2016
		Infested in 2015		Not infested on 30.09.2015		Effective in 2015 (ha)	Prognosis in 2016 (ha)	Pheromonal traps (pieces)
		Beetles no.	Volum thosands mc	Beetles no.	Volum thosands mc			
1	Bistra	760	0.661	148	0.141	996	996	152
2	Ciban	875	0.831	181	0.206	882	150	180
3	Curpăt	931	0.835	185	0.164	612	188	188
	Total	**2.566**	**2.327**	**514**	**0.511**	**2.490**	**1.334**	**520**

Table 2. The first stage. The Ipidae attack in the resinous forests in 2016

Nr. crt.	U.P.(den umire)	u.a./group s u.a.	The surface of resinous forests (ha)		Density of populations (nr.of holes/m^2)	The trees infestated		Nr. of trees with traps		The trees (trap and control for monitoring and diminuation of the populations)
			Total	Which infested		I	II	I	II	
1	Bistra	21-171	2.000	996	47	1.392	148	464	296	760
2	Ciban	12-196	2.680	882	44	1.614	181	538	362	900
3	Curpăt	1-175	2.000	612	49	1.716	185	572	370	942
	Total		**6.680**	**2.490**	**140**	**4.722**	**514**	**1.574**	**1.028**	**2.602**

Table 3. Attack of Ipidae in 2016

UP Name of Ocol Silvic	UP Bazine	ua Groups	The surface of the resinous forest		Density of a population Nr.of holes/m^2	Infested trees		Trap trees		Total trap trees I+II	Barrier traps
			Total	Infested		Category I	Category II	Category I	Category II		
Bistra	**III Bistra**	21-75	600	310	42	288	32	96	64	160	32
		76-127	650	243	48	345	38	115	76	191	38
		128-171	750	443	52	759	78	253	156	409	82
Total UP III Bistra			**2.000**	**996**	**x**	**1.392**	**148**	**464**	**296**	**760**	**152**
Ciban	**IV Ciban**	12-39	400	229	46	510	15	170	30	200	40
		40-85	350	141	45	360	40	120	80	200	40
		86-120	300	124	42	201	39	67	78	145	29
		121-157	600	230	40	183	37	61	74	135	27
		158-196	1.030	158	48	360	50	120	100	220	44
Total IV Ciban			**2.680**	**882**	**x**	**1.614**	**181**	**538**	**362**	**900**	**180**
Curpăt	**V Curpăt**	1-37	300	167	42	324	41	108	82	190	38
		38-87	450	122	52	390	35	130	70	200	40
		88-133	450	118	48	378	32	126	64	190	38
		124-175	800	205	52	624	77	208	154	362	72
Total UP V Curpăt		-	**2.000**	**612**	**x**	**1.716**	**185**	**572**	**370**	**942**	**188**
Total Bistra Ocol			**6.680**	**2.490**	**x**	**4.722**	**514**	**1.574**	**1.028**	**2.602**	**520**

Although the abundance of the captures and medium number of insects on trap were different in the studied years, the infestation degree was a strong one. As we showed formerly, we followed more detailed the situation in u.a. III Bistra, IV Ciban and V Curpăt where were places 520 pheromonal traps. The analysis of the captures pointed out the following data: in UP III Bistra were 996 infested trees, and then UP IV Ciban with 882 infested trees and in UP V Pode the numer of infested trees was 621. From the total surface of 6.680 ha, 2.490 trees were infested, that represents 37,25%, the attack being a medium one. The causes consist of installing the supplementaries traps in 2016 but also of favourable conditions produced by felled and broken trees because of snow.

The most numerous captured were in UP III Bistra with 996 infested trees. This situation confirms the conclusion that here there is an posible infestation center. The abundances of the captures is motivates for this u.a. because here the flight began in April, while in the other zones of collecting, the beginning of this is in May month.

The most early captures were achieved in April, and the most late in September. The maximum of captures were made in June and July.

This evolution of the captures it was found again during these two years, when the maximum was reached in June. About the evolution of the captures on months, the tendencey is the same in all 3UP (Table 3). The captures were conditioned by the general evolution of flyght, by the regime of the climatic factors for every years, but also by the traps place. They are difference from one point to the other, determined by the local conditions of every UP.

Similar studies were carried out over time in Forest District of Răşinari (Sibiu County) [2] where were

captured a number of 4,146 adults, of *Ips typographus* of which 2,173 samples in 2013 and 1,973 samples in 2012. In the Forest District Orăştie (Hunedoara County) [9] in spruce und mixed forests (3883.5 ha), between 730-1490 m altitude, 2.455 individuals were sampled with tubular pheromones traps and barrier type traps with Atvatyp baits, from 43 sampling points, and in Dumbrava Sibiului Forest (Sibiu, Romania) [3-8]. Also a group of researchers from Romania published article about xylophagous insects [13].

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