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ASPECTS REGARDING THE DINAMICS OF PEST POPULATIONS TO THE CONIFEROUS FORESTS OF THE UPPER BASIN OF THE DOAMNEI RIVER

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ABSTRACT. The research of harmful insects for pine forest was achieved in two distinct areas: the hilly area of the village Pietroşani (Argeş) and the mountain area Clăbucet during the years 2008 and 2009. Using various methods of study, in the mentioned areas, we identified the following species of insects: *Ips typographus, Hilastes ater, Pytiogenes chalcographus, Hylurgops palliatus.* Among these the first three had numeric explosion causing major damage to the forests. By processing the field data we determined: the intensity of the attack, the insect population density, the frequency of the attacked trees, the propagation coefficient, and the abundance. Knowing all these parameters it was possible to develop short-term forecasts useful in forestry.
KEYWORDS: Arges county, harmful insects, *Ips typographus, Hilastes ater, Pytiogenes chalcographus, Hylurgops palliatus*

INTRODUCTION

In the project area, environmental studies on forest pests were not conducted that's why the main objectives of the research were:

- identification of harmful insects in coniferous forests and plantations;
- tracking and describing the life cycle of these insect pests;
- use appropriate methods and techniques to describe the population dynamics of insect pests;
- carrying out short-term forecasts of pest populations;
- identify and describe the ecological effects of insects on forest products.

The Clăbucet mountain area, located in the central-southern region of Fagaras Mountains, has seen significant changes that have contributed to some climatic factors on the other anthropogenic factors. In 2005 a storm caused damages that included 5 hectares in the forest area. Removal of timber was defective because of inaccessibility, much remains untapped timber. In 2007 plantations were set up 2 (A and B) with juvenile spruce separated by a curtain of woods with a width of 500m. The following year we found that most of the seedlings were debilitated and even dried.

The following year found that most of the seedlings were debilitated and even dried. On the basis of the analysis conducted by I. C. Brasov was confirmed that the drying of seedlings was caused by tropilaelaps *Hilastes ater* and have taken steps to combat. In the spring of that year we found the presence of *Ips typographus*. The second research area is situated in the village where the Pietroşani spruce forest was founded 45 years ago. Being the only forest of its kind in the area on its surface numerous cuts were made illegal, and the wood, was used in construction or for Christmas trees.

Remaining logs trouser-legs there, allowed the development of insects: *Pytiogenes chalcographus*, *Hylurgops palliatus*.

RESEARCH METHODS AND TECHNIQUES

In softwood there have been identified attacks of *Ips typographus, Pityogenes chalcographus, Hilastes ater*, insects that grow under the bark of trees consuming liberian vessels causing dry trees. The attacks are favored by improper exploitation of wood, these attacks are located only around logging. This pest was identified by direct observation of health status of trees. The existence of the inlet in the bark, red leaves, peeling bark are signs of an attack. To collect data on population dynamics can be achieved using the following methods:

- galleries counting on a given area;
- using trap trees;
- using trap bark;
- using pheromone-tubes;
- using trap poles.

RESULTS AND DISCUSSIONS

Ips typographus

Ips typographus (figure 1) is one of the most widespread species with great potential harmful besides attacking spruce and other coniferous species such as fir, pine laricele. It is located on the trunk and often attacks forest during 80-100 years. *Ips typographus* was identified in both regions, but in mountainous areas has made graduations. The attack was mostly in the edge surrounding planting. Insect research was conducted from of May 15th to September 5th, 2008. For numerical evaluation of pest populations we have used the following methods:

- using trap trees (figure 2);
- race-type cage (figure 3);
- tubes pheromones;
- galleries counting a certain surface.

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Fig. 1 Ips typographus

Fig. 2 Trap tree

Fig. 3 Race-type cage

Using these methods we discovered that the insect flight began on May 15th and ended on 20th August (15 weeks). The data we have obtained, allowed us to follow the number of population (table 1).

Table 1

Numerical evolution of the population

No.	Used phero-mone	Type of trap	Total	Date of maximum atack	Number of insects per month			
					V	VI	VII	VIII
1.	Atratyp	Cage	1377	29.05	915	138	272	44
2.	Atratyp	PVC	1130	29.05	688	94	288	53

Parallel to the prosecution voyage pheromones were surveyed in the bark of trees to see the state of race evolving but the intensity of insect attack. In the researched area Ips typographus presented three flights. The first one took place at the end of May, the day of maximum capture being the 28th May. The second flight (the sister generation flight) took place between June and July. The number of captured individuals represent 22% of the number of individuals from the first flight. The third flight is unimportant, the majority of individuals sheltering for winter under different forms. We also noticed the enhanced efficiency of the pheromonal trap comparative with the PVC tubes. The attack was strong at the edge of the forest and dropped in intensity in the middle of it. The increase in number of the population is due to:

- the massive deforestation in the area of the spruce grove;
- the non-observance of forest norms within the exploiting;
- the absence of a natural protection, due to the cutting of trees on the peak of the slope;
- the presence of knocked down trees because of different storms in inaccessible areas for exploitation;
- the exposing of the arboretum in a sunny area.

The combination of all these factors determined the numerical explosion of the population. The limitation of the spreading of this insect was accomplished by cutting the attacked trees, the installing of trap trees and the pheromonal traps. The exploiting of the attacked trees created advantageous conditions for the numerical increase of another damaging insects.

Hylastes ater

Hylastes ater (figure 4) is a species of pine plantations met with Hylastes cunicularius. As a rule, it can have 1 - 2 generations per year. The flight takes place in late April to early June, the summer flight takes place in the latter part of July to September. After mating, the female deposited eggs in the bark of trees and their roots and the bark of young trees (Simionescu A., 1971). Favorable environment for oviposition is considered to be remnants of wood with fresh shell buried in the ground during operation. The insect was investigated in the Clăbucet area weekly, at the established plantations. The bottom of the plantation was sprayed with Decis and on the top, due to the inaccessibility of chemical treatment there have been installed trap rugs and trap stakes. The plantation has been limited to test markets designed to 100 m^2. Each market has followed the viability of juveniles. At first sight the total number of juveniles (approximately 50) of the market for only 4 were dried sample. This number seems insignificant but most of the seedlings were dried even if they were attacked. This attack produces drying of the seedlings because the bug eats the liberian vessels. This observation about the viability of seedlings was performed on May 5th, 2008. It is very difficult to make a difference between healthy juveniles and those that are attacked; due to climatic conditions the

most of leaves have a yellow - green colour. The only criterion of distinction is the juveniles in depth research. This method requires the removal of juveniles from the ground and checking the attacked area. The method has the disadvantage that besides the attacked juveniles the healthy ones may be cast away. In the studied area there were randomly drawn 5 seedlings and found the following were discovered:

- adults are located in the lodges of body size;
- 18 adults were identified the maximum number of juveniles being 6;
- the degree of injury varies from brood to brood from simple lodges to real channels carved in wood, bark and seedlings.

In parallel with work undertaken in the Forestry Department where spraying hasn't been done the surface of the sample was installed in trap stakes. The trap poles came from the branches of trees that were debilitated to be exploited. They were sized to a length of about 40 cm with a variable diameter 1,5-8 cm. The trap poles were installed in pits at a depth of 20 cm covering the earth is 2 / 3 of their length. They stood grouped in the market for 5-10 each (figure 5).

Fig. 4 Hylates ater

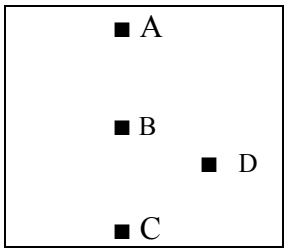

Fig. 5 Trap poles' cluster

According to literature (Tuca I., 1996), there should be checking flights after the mating flight and they occur in late May and early June. On June 20th there were taken trap poles of the 4 areas of location of poles race. Except for 2 stakes stakes all the analysed stakes have attack traces. Install poles prevailed attacks on aging. Adults preferred to attack seem small diameter aging and look great for deposit eggs in diameter. The average number of adults was 3.5. We calculated the total area of poles and reese race that is medium to strong attack. On a 1 m^2 we have concluded that there is an average number of 44 individuals.

Instead of extracted poles were there installed other developments to capture the pests. July 10th was considered one of the sample appear once in each market to capture the developmental stage of insects. Total number of larvae was 25 over an area of 0.45 m^2. Analysis poles of July 20th only caught larvae. Analysis poles of July 20th only caught larvae. On August 1th were identified larvae, and adults. Percentage stern is 90% of the total number of individuals. On September 1th there were examined stakes placed on June 10th and was surprised the 2nd attack. The data collected on the field allowed us to devise the following statistics (table 2).

Table 2

Statistic chart for Hyllastes ater

Number of poles	Total surface	Average number of individuals on a pole	Average number of individuals on m^2	Variance	Standard deviation	Standard error of the average number
10	0.531 m^2	8.1	152	40	6.3	2

Propagation coefficient is the ratio of density of two successive generations C = 152/44 → C = 3.4. The increase of the population was determined by the numerous vegetal remains after the forest exploitations. The branches and the stumps represent the ideal environment for the developing of the insect. The aspersions made at the basis of the plantation haven't been efficient, the mortality of the seedlings the being almost the same all around the trial areas. The use of the trap barks didn't attract the pest because they were deteriorated under the action of the climate factors. The use of the trap bark from the exploited trees allowed the installing of the bark bug on it. The trap poles having a diameter longer than 4 cm were very efficient when capturing the damager. The rebuild of the plantation was made in the spring of the year 2009. In order to avoid a new attack, the seedlings were bathed in insecticide and the number of trap poles was doubled.

Pytiogenes chalcographus

The spruce fir bark beetle (figure 6) is a common pest for our woods, this insect may attack fir, pine and laricele. It has 2 generations per yea. The first flight takes place somewhat earlier in April than the *Ips typographus* and the second in July-August. The insect was detected both in „Clăbucet" area and „Stufoasa". In both areas, timber remained after operation (trunks, branching), being an ideal environment for insect development.In the trees there weren't ony attacks, but the vegetable remains allowed a gradual increase in pest populations.

Fig. 6 Pytiogenes chalcographus

Fig. 7 Suite room and maternal galleries

On April 20th, 2008, from observations of debris left over from exploitation, found there to cover the inlet and suite rooms (figure 7). In an area of 100 cm^2 it was revealed an average number of 1-2 holes. On May 16th by random bores, the stage of development of the insect was noticed (table 3).

Table 3

The stage of the insect's development at 16th Mai

Number	Surface	No. of eggs	No. of larvae	No. of chrysalis.	Adults
1	100 cm^2	62	18	0	4
2		72	14	0	6
3		132	21	0	9
4		60	6	0	3
5		65	15	0	2
Average		78.2	14.8	0	4.8

On June 15th, by random bores, the stage of development of the insect was noticed (table 4).

Table 4

The stage of the insect's development at 15th June

Number	Surface	No. of eggs	No. of larvae	No. of chrysalis	Adults
1	100 cm^2	0	7	75	12
2		0	0	86	4
3		0	6	82	9
4		0	3	102	10
5		0	9	110	7
Average		0	5	105	8.4

In early July, the 2nd flight of insects took place. The average number of the inlet to cover an area of 100 cm^2 is 2.5-3 adults and the maternal galleries 10-12. On a 1 m^2 we have concluded that there is an average number of 300_galleries. The value is associated to a middle attack. It is known that a female lays on average 16 - 20 egs, the number of individuals is around 160 and 200 per 100 square centimeters. The data from the field confirmed the theoretical data, and on 7th September 2008, by random probing, we have found these:

- the average number of individuals on 100 square centimeters is 157.
- 40% of individuals are chrysalis.

On June 7th, 2009 from the collection of evidence we found that:

- the average number of the inlet is 5.5 per 100 cm^2;
- the average number of mother galleries is 21 per 100 cm^2;
- the average number of larvae is 330 per 100 cm^2.

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On a 1 m² we have concluded that there is an average number of 550 galleries. This value corresponds to a strong attack (Simionescu A., 1997).

The data collected on the field us to follow the numeric evolution of the population (figure 8).

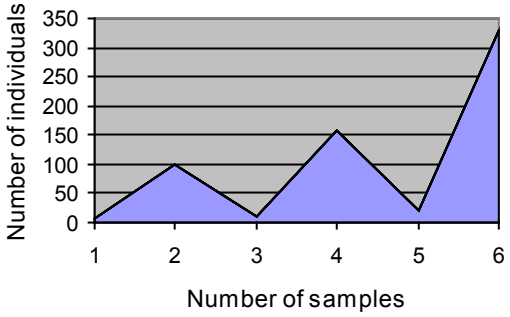

Fig. 8 Numerical values of the Pityogenes chalcographus population registered by sounding in the crust

1 - the number of individuals at the beginning of attack – 2008;

2 - the number of individuals at the end of the first attack;

3 - the number of individuals at the beginning of the second attack;

4 - the number of individuals at the end of the second attack;

5 - the number of individuals at the beginning of the first attack – 2009;

6 - the number of individuals at the end of the first attack.

The increase of the population obey the following formula: N= n×40 - 20%N, where N represent the average number of inndividuals at the beginning of the attack. Applying this formula allow the devising of a prognosis for the numeric evolution of the *Pityogenes chalcographus* population.

Hylurgops palliatus

It frequently attacks the spruce beetle, but it installs on damaged trees, the remaining of trees that are resulted from logging, wood of spruce and pine. In this wood we have delimited a 400 square metres surface, where we checked the remainings, the fallen trees, the damaged trees. On 2th May 2008, we identified and analyzed 5 high remains and we concluded the followings:

- the presence of simple holes with a single adult in each one;
- suite rooms recently drilled with 1 - 2 adults (figure 9) in each one;
- suite rooms with a 4 - 7 cm diameter, irregular drilled, with 3-4 adults in it. On 12th May**,** we checked the rooms and we concluded the followings:
- one of them was recently drilled, and in the other 4 rooms we found adults;
- the average number suite rooms was 4 on a surface of 100 square cm.

Fig. 9 Hylurgops palliatus (adults and eggs)

On 30th May**,** we checked the rooms and we concluded the followings:

- a recently drilled room with 3 adults;
- a room with adults (and 28 egs);
- 8 suite rooms with adults, egs (fig. 9) and larvae of various sizes;
- the number of larvae in those 8 galleries: 12, 18, 21, 17, 23, 14, 24, 16;
- the length of the galleries drilled by the larvae is from 6 mm to 15 mm.

On 28th June**,** we checked in different zones of a surface of 100 cm² and the stage of development of the insect was noticed (table 5).

Table 5

The stage of the insect's development at 28th June

Number	Surface	No. of eggs	No. of larvae	No. of chrysalis	Adults
1	100 cm²	0	0	1	10
2		0	0	18	8
3		0	0	0	14
4		0	0	47	2
5		0	0	13	5
Total		0	0	79	39
Average		0	0	15.8	7.8

Comparing the data from the last two tables show that the stage is almost completed and stern adults leave the galleries were formed. Subsequent analysis conducted on July 6th have identified a number of 3 larvae and 2 chrysalis. As a result we can say that the life cycle starts at the beginning of May and lasts till the first half of June. On the investigated surface, we identified 12 stumps of different heights, and 5 of these were investigated and we obtained the following results (table 6).

Table 6

Statistic chart for Hylurgops palliatus

Inves-tory stumps	Total surface (m^2)	No. of nuptial rooms	Average number of individuals/ $0.01m^2$	Average number of individuals/$0.01m^2$ at the end of the attack
5	2.066	375	4.6	56
			Standard deviation from the average 0.64	Standard deviation from the average 2.8

For the investigated species the unit surface was 100 square cm. In this case, the density was 2.5 – 3.5 individuals per 100 square cm at the beginning of the attack and 60 individuals per 100 square cm at the end of the attack. The propagation coefficient (C) represents the ratio of 2 successive generations. C = 60/3.5 → C = 17.14. The big number of individuals from the second generation per unit surface indicates that the insect falls in the mark. The species had only a generation in the year 2008, the coefficient of multiplication being 17. The following year, in 2009 Hilurgops paliatus accomplished a maturation attack without laying eggs. In Germany and France the species presents 1-2 generations a year (Dumouchel L., 2004). Field research show that *Hylurgops palliatus* can have several generations of offsprings yearly.

CONCLUSIONS:

Conifers have a low resistance to insect pests compared to hardwoods. Climatic and anthropogenic factors have contributed to triggering a larger number of populations of insects. The studied insects have 2 generations per year, the attack was the most intense in spring. Control and detection of *Ips typographus* was made with two types of traps, and the most effective was the pheromone trap. The number of individuals belonging to generation sister is 22% of the total number of first generation individuals. The flight of the second generation is insignificant. After the second flight the average number of individuals per square meter of bark is the average of 340. The attack was strong at the exterior of the forest and decreases to its interior. For species found *Hilastes ater* a tripling of the number of individuals in the second generation. There were no reported major differences between the area where spraying was done with Decis and the unsprayed area regarding the intensity of the attack. The *Pytiogenes chalcographus* insect was identified in both areas. The intensity of the attack was in the mid-mountain and hilly area has surprised a gradual increase. The growing of the population respects the following algorithm: N= n×40 - 20%N

Where: N - is the average number of individuals at the end of the second attack; n - is the average number of individuals at the beginning of the attack. At the *Hilurgops paliatus* species we ascertain the existence of a maturation attack in the next year without laying eggs. The species had a single generation, the matting coefficient in 2008 being 17. Field research show that *Hylurgops palliatus* can have several generations of offsprings yearly. Because the pest populations are causing a decrease of annual productivity, a decrease of wood percent, the drying of the trees, destruction of the fruits and seeds, is necessary a close surveillance of the woods and of the pest insects.

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