MONITORING OF *COLEOPHORA LARICELLA* HB. IN A LARCH SEED ORCHARD SITUATED IN CENTRE OF TRANSYLVANIA, ROMANIA

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Abstract. *A rich complex of pests, which could cause damages both in quality and quantity, can often affect the larch forests and larch orchards. Because within this complex, larch case-bearer (Coleophora laricella Hb.) occupies a special place, in a larch seed orchard situated in Baciu (Cluj), centre of Transylvania, Romania, ten pheromonal traps with clue were placed within the panel. The traps were placed within the orchard on May 22, 2010, and in the period of May 26 and July 31, twenty regular observations were made by reading the captures. Maximum flight curve was reached about three weeks from the onset of the flight, date by which 47 captures were made. Adult flight ended around July 31, the entire flight activity ranging within 66 days. In this interval, there were captured 442 males, from which 8 in May, 254 in June and 180 in July. The number of captures made by a pheromone trap ranged from 34 to 51 adults/trap, the average being 44.2 adults per trap. The maximum of captures made by a trap on the interval between two successive readings was of 10 adults per trap. This phenomenon was achieved during the peak of the flight curve and was recorded by traps located on the outskirts of the experimental lot. Traps with sexual-attractant pheromone may be successfully used in the activity of monitoring pests and also for specie's combat through mass capture of males.*

Keywords: *Coleophora laricella*, genus *Larix*, pheromonal trap, orchard

INTRODUCTION

In the second half of the 20th century, the rapidly-growing allochthonous species from genus *Larix* Miller, 1754 were very popular in Europa, and as a result, were frequently used in the processes of recultivation and reforestation (Bankovic et al., 2009). *Coleophora laricella* inhabits the entire Northern hemisphere (Europe, large parts of Asia and North America, where it was introduced in 1886). It is believed that its original habitat is the eastern mid-Alps, whence the host plant European larch (*Larix decidua*) spread into the plains of North-Eastern Europe and further. Today larch casebearer inhabits all areas in which larch grows which results from its adaptability to site conditions. It occurs not only in upland, but also in lowland areas. The larch casebearer is a very obstinate and harmful forest insect on dry and sunny areas, as well as in plains and highland. In suitable places it has a permanent fluctuation, and in artificial stands the outbreak can last for as long as 12 years (Tabakovic-Tosic, 2011).

The larch casebearer, *Coleophora laricella* Hübner, 1817 (Syn.: *Tinea laricella* Hübner, 1817) (Lepidoptera, Coleophoridae) is a widespread monophagous species, to the greatest extent connected to the genus *Larix* (mainly *L. decidua*: Miller, 1768; *L. kaempferi* (Lamb.): Carrière, 1855; *L. occidentalis*: Nuttall, 1849; *L. laricina* (Du Roi): Koch, 1873) (Habermann, 2009).

After Brudea (2003) moths have the wingspan of 9-10 mm, the female being smaller than the male. Anterior wings are larger, gray-brown colored, slightly shiny, with little fringes and the posteriors are dark-gray, narrow and with fringes.

The egg is yellowish, hemispherical and with longitudinal increases. Before hatching, the egg becomes gray. The larva is small, brown-red or light yellowish, with the head of dark color, with chitin plates on segments 1 and 2 and with the last pair of abdominal legs developed. It reaches a length of 5 mm. The nympha is brown- blackish, thin and has a length of 4-6 mm. The nympha is housed in a pouch obtained from the mined, cut needle. The moth of larch needles in the larval stage winters in little bags formed inside the attacked larch needle. Early spring, the larva continues its attack and increases the hibernating bag by attaching a new portion of mined needle. By the end of April, it sets the bag on a needle or on branches and becomes a nympha.

Adult flight occurs from late May. After copulation, the females lay the eggs isolated on the needles. After hatching, the larva penetrates the needle, mines it and, as a consequence of the attack, the needles fade and by the end the attack has the aspect of damage caused by frost. Larvae prefer needless from the outer edge of the crown. The attack starts in the superior part of the crown and, in the case of a serious attack, larvae settle on strings of silk towards the inferior part of the crown. The attack is extremely dangerous because it produces repeated exfoliations, which, finally, put an end to annual increases or even dry branches and/ or trees. In September, the larva cuts a portion from a mined needle in order to make a protective integument in the form of a bag and then moves on branches and stems where it ebbs for winter, in bark crevices or under lichens (Oltean, 2005).

To maintain the populations of *Coleophora laricella* Hb. below PED value and in order to imprint a decreasing trend to the dynamics of the population, it is essential to establish a complex strategy of prevent and combat. Within these strategies, in most cases chemical treatments are used (Olenici, 1994). Although the method presents high biological effectiveness, in time it was found that chemotherapy had collateral effects. In order to avoid these effects, it is necessary to use other combat methods, methods that start from the behavioral traits of the specie. It is within this context that the research held this year enrolls.

For this specie on the market was launched a sexual-attractant pheromone. This pheromone is synthesized at the Chemistry Institute ‘Raluca Ripan’ Cluj-Napoca. Its use doesn’t affect the biological balance, this biopesticide being selective for Entomofauna useful in forestry ecosystems.

The synthetic pheromone can be used for the following activities:

To specify the bio-ecology of the specie. After hourly and daily recording of the captures, in correlation with tracking the evolution of the ecological factors we can obtain precious information on the bio-ecology of the specie, information impossible or very difficult to obtain through other methods.

Detection of new infections. Since early infection is achieved with a very small number of individuals, sometimes dispersed on long distances, the classical means of detection (visual observation, field surveys) are very laborious and present low efficiency. The traps with pheromone baits, through their high effectiveness and

their selectiveness of attraction compensate the minus of the former mentioned methods.

Forecast and warning actions. One of the major goals of forecast and warning activity is to establish in advance the critical periods of the evolutionary cycle of a pest, the periods when the pest presents the maximum of vulnerability towards specific means of combat, (chemical treatment), before the damage has occurred. The precise determination of these periods allows obtaining maximum technological effects with minim dosage of insecticides or biological means, thus increasing economic and ecologic efficiency.

Combat actions through mass capture of males. Pheromones may be used for direct combat actions through mass capture of males. The principle of the method is the capture and the removal of males from the habitat. In these conditions, in order to have a practical value, the capture of males from the natural habitat must be total or, at least, to a sufficient extent so that the majority of the females are not to be fecundated, not to lay eggs or lay sterile eggs and thus the population to fall in the next generations.

Combat actions by disrupting the normal pheromone transmission. If during the realization of this sequence it is introduced a sufficient dose and evenly-spread of sexual-attractant pheromone, the individuals that would normally be attracted become incapable of finding radiating partners (they are confused), the ultimate result being the prevention of mating and the subsequent collapse of the population (Rosca, 2009).

MATERIAL AND METHOD

Geographical and climatic characteristics of the study area

The present study was conducted in Baciu larch orchard, Cluj Forestry-Forestry Department of Cluj-Napoca, (Romania) with a surface of 8.5 ha. Baciu orchard is situated at 46°8' latitude, 23°52' longitude and a medium altitude of 357 m. The orchard was established during 1975-1978, aiming to produce genetically ameliorated seeds. Geographically, Cluj Forestry Department is situated in the region of hills and plateaus of northern Transylvania, in the north - west of Romania and includes the hydrographic basin of Somes Mic.

The study material is composed by larch clones obtained by breeding from plus trees selected from different natural or artificial larch populations from Romania (Fig.1). The studied provenances were: Gura Humorului (258 trees); Valea Cetăţii (180 trees); Săcele (72 trees); Valea Popii (125 trees); Sinaia (112 trees); Anina (109 trees); Latoriţa (109 trees).

The general climatic conditions framed between -2.1°C and 20.5°C for temperatures. Relative air humidity framed between the limits of 46.8% and 96.1% and the highest duration of sun shine was recorded in July (Table 1).

The studied traits

In 2010, in the larch orchard, as far as the populations of *Coleophora laricella* Hb. are concerned, the following objectives were proposed:

- monitoring larch vegetation phenophases;
- monitoring *Coleophora laricella* Hb. populations by capturing males with pheromonal traps.

In order to realize these objectives, there were used traps with the specific sexual-attractant pheromone 'AtraLar'. In the experimental parcel ten traps were placed. The traps were placed in the culture in May 22, 2010 and between May 26 and July 31 there were conducted periodical observations by reading captures (20 readings were made).

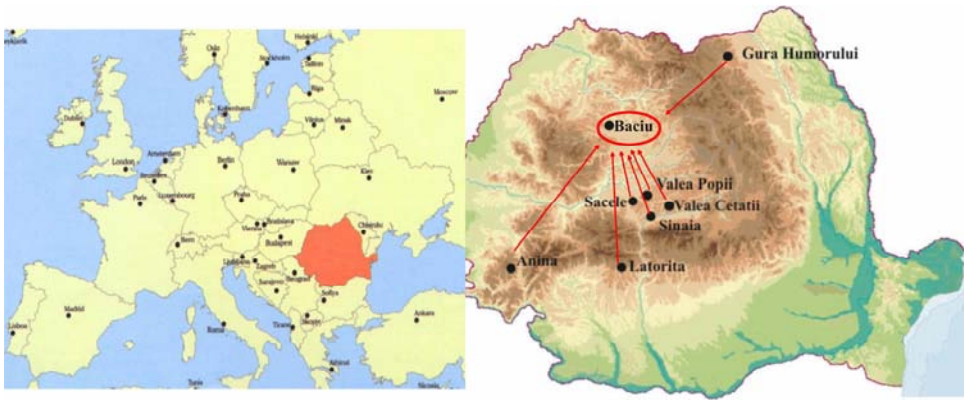

Fig. 1. The studied larch populations from Romania

Table 1

Climacteric conditions in Baciu Orchard, January- December 2010

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual average
Thermal regime (°C)													
Monthly average	-2.1	-0.5	3.9	12.7	15.6	18.4	20.5	19.9	16.5	9.6	5.6	0.5	10.38
Pluviometric regime (mm)													
Monthly average	15.7	40.39	74.93	9.65	33.78	128.2	54.61	45.9	4.58	90.68	47.78	43.68	589.8
Duration of sun shine (h)													
Monthly average	77.4	111.3	117.8	180.6	193.8	184.3	201.3	113.5	111.4	100.7	56.4	68.0	1522.5
Relative air humidity (%)													
Monthly average	83.0	85.2	96.1	46.8	65.6	87.3	48.2	60.9	51.7	88.6	86.2	87.4	73.91

RESULTS AND DISCUSSION

In the orchard, in 2010, larch started growing/ vegetating in the last decade of March, when bud began. At the beginning of March leaf phenophase started and, by the end of the month, the blooming (Table 2).

Table 2

Larch phenophase of vegetation

Specie	Budding	Leafing		Blooming	Colouring leaves	Vegetation period (days)
		Start	Generalization			
Larix decidua	24.03.2010	02.04.2010	19.04.2010	26.04.2010	20.10.2010	210

Table 3

Capture situation

Nr. sample	Phero mone	Trap installment date	Observation date																				Total
			May		June									July									
			26	29	2	5	9	12	16	19	23	26	30	3	7	10	14	17	21	24	28	31	
1	Atralar	22.05. 2010	-	1	1	2	1	2	1	2	1	1	1	1	1	5	2	3	2	1	2	4	34
2			-	-	3	1	3	1	3	8	2	3	2	1	7	1	1	2	4	-	1	-	43
3			1	1	1	1	6	2	2	6	1	1	1	1	1	3	4	5	5	2	4	2	50
4			-	2	7	2	1	1	1	2	2	1	1	2	4	1	3	1	7	1	-	-	39
5			-	-	1	8	2	6	10	1	4	2	1	1	2	2	2	1	1	4	2	1	51
6			1	-	2	3	7	3	4	9	2	1	1	2	3	1	1	2	3	1	1	1	48
7			-	1	3	1	3	1	4	10	1	2	2	1	1	4	1	4	-	3	2	-	44
8			-	-	5	4	1	5	2	1	1	1	1	1	1	1	5	3	4	-	3	2	41
9			-	1	6	5	1	7	3	6	2	2	3	1	3	2	1	2	2	1	-	1	49
10			-	-	4	7	1	1	8	2	1	1	2	2	1	1	7	-	1	1	1	2	43
Total			2	6	33	34	26	29	38	47	17	15	15	13	24	21	27	23	29	14	16	13	**442**

In 2010, adult flight for mine moth of larch needle, *Coleophora laricella* Hb., started in May 26, date by which 2 males were captured. Mass flight started about a week later, so that around June 2, with 10 pheromonal traps 33 more specimens were captured. The maximum of the flight curve was reached about 3 weeks from the beginning of the flight, this being recorded on June 19, date by which 47 captures were made.

By the end of this activity a second peak of flight was recorded, around the date of July 21, date by which 29 adults were captured. (Fig. 2).

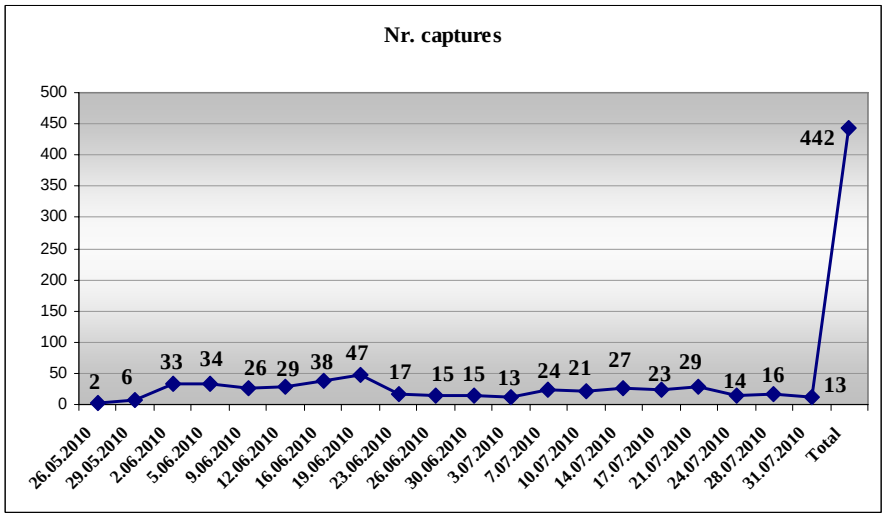

Fig. 2. The graphic for flight curve

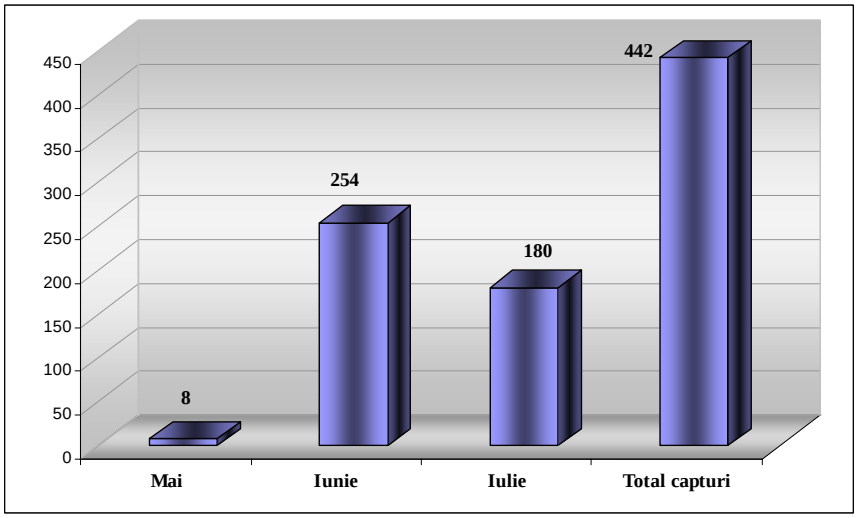

Fig. 3. Number of captures per months

Adult flight ended around 31 July, the entire flight activity ranging on an interval of 66 days. In this interval 442 males were captured, from which 8 in May, 254 in June and 180 in July (Fig. 3).

From table 3 it is easily noticeable that the number of captures made by a pheromonal trap ranged between 34 adults/ trap (trap nr. 1) and 51 adults/ trap (trap nr. 5), the average being of 44,2 adults per trap.

The maximum number of captures made by a trap within the interval between two successive readings was of 10 adults/ trap. This phenomenon was achieved during the peak of flight curve, with trap nr. 5 and trap nr. 7, traps located at the outskirts of the experimental lot.

CONCLUSIONS

The mining moth of larch needle, *Coleophora laricella* Hb., is a pest of economic importance for the Larch orchard situated in Cluj.

In the climacteric conditions of the area, adults from winter generation start their flight in the last decade of May. Maximum flight curve occurs at about 3 weeks from the flight's onset.

Adult flight period unfolds on an interval of about 9 weeks, interval in which the females depose the ponta.

Traps with sexual-attractant pheromone may be successfully used in the activity of monitoring pests and also for specie's combat through mass capture of males.

In 2010, the medium number of captures made by a trap was of 44.2 adults per trap.

REFERENCES

1. Bankovic, S., M. Medarevic, D. Pantic and N. Petrovic (2009). *National Forest Inventory of the Republic of Serbia-Forests of the Republic of Serbia.* Ministry of Agriculture, Forestry and Water Management -Forest Directory, Belgrade, pp.1-244.

2. Habermann, M. and A. Ott (2009). *Feeding patterns of the larch casebearer* Coleophora laricella *Hbn. (Lep., Coleophoridae) on European larch*, Journal of Applied Entomology, Vol. 119, Issue 1-5, pp. 581-584.

3. Oltean, I. (2005). *"Special-forest pests Entomology"*, Ed. AcademicPres, Cluj-Napoca, pp. 89-91.

4. Olenici, N. (1994). *Approval of the forest pest control areas for 1994*, Bukovina Forest, second year, no. 1.

5. Roşca, I., I. Rada (2009). *Treaty of entomology*, Ed. Alpha MDN, Buzău, pp. 518.

6. Tabakovic-Tosic, M., Dragutin Tosic, Snezana Rajkovic, Vesna Golubovic-Curguz and Ljubinko Rakonjac (2011). *Invasion species Coleophora laricella - One of the main limiting factors of Larix decidua during the forest aforestation and recultivation.* African Journal of Agricultural Research Vol. 6(4), pp. 866-872.