

# MONITORING *LYMANTRIA MONACHA* L. DEFOLIATOR ON CONIFEROUS TREES, FOR AN ALERT OUTBREAK OCCURRENCE

## MONITORIZAREA DEFOLIATORULUI *LYMANTRIA MONACHA* L. ÎN CUPRINSUL ARBORETELOR DE RĂȘINOASE, ÎN VEDEREA SEMNALĂRII ÎN TIMP UTIL A APARIȚIEI GRADAȚILOR

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**Abstract.** *Lymantria monacha* (L.) (Lepidoptera: Lymantriidae) may produce extremely dangerous defoliations to conifers, because – even at low intensities – the physiological processes of trees are heavily disturbed, leading to weaknesses of the infested specimens which are subsequently attacked by species of Scolytidae. Populations are monitored in the entire forest with pure coniferous trees and with mixtures of conifers and beech, regardless of ownership, by the national network of pheromone traps. According to the regulations in force, pheromone traps density is 1/50 ha, 1/100 ha and 1/200 ha, depending on the vulnerability of the area to outbreak occurrence. Data are collected throughout the country from the state and private forests administered by the National Forest Administration (R.N.P.)

**Key words:** *Lymantria monacha*, heavily disturbed, trap density.

**Rezumat.** *Lymantria monacha* poate produce defolieri la rășinoase extrem de periculoase, deoarece chiar la intensități scăzute, procesele fiziologice ale arborilor sunt puternic perturbate, producându-se debilitarea exemplarelor infestate care ulterior sunt atacate de specii de Scolytidae. Populațiile sunt monitorizate la nivelul întregului fond forestier cu arborete de rășinoase și de amestec a acestora cu fagul, indiferent de natura proprietății, prin rețeaua națională de curse feromonale. Conform instrucțiunilor în vigoare, desimea curselor feromonale este de 1/50 ha, 1/100 ha și 1/200 ha, în funcție de vulnerabilitatea zonei la gradații. Centralizarea datelor din cuprinsul țării din pădurile de stat cât și cele private administrate de Regia Națională a Pădurilor, privind numărul mediu și maxim de fluturi capturați la cursele amorțate cu nade *Atralymon*, permite urmărirea evoluției populațiilor defoliatorului, atât în diferite zone din țară, cât și la nivel național și acest studiu este cuprins în lucrare.

**Cuvinte cheie:** *Lymantria monacha*, puternic perturbate, desimea curselor

### INTRODUCTION

The nun moth *Lymantria monacha* L. is a widely distributed species, almost all over Europe, up to Western Siberia, more numerous in the center (Poland, Germany, Czech Republic, Slovakia), and in the eastern part of the

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continent (Belarus, Ukraine, Russia, Lithuania) (Karsholt et al., 2007). Polyphagous (feeding on the foliage of over 200 species), it attacks especially resinous, but it can also be found on many deciduous trees. *L. monacha* prefers and most frequently damages *Picea abies* (L.) (Norway spruce), *Pinus sylvestris* L. (Scots pine), *Abies alba* Mill. (silver fir), *Larix decidua* Mill. (European larch) and *Pseudotsuga menziesii* Mirb. (Douglas fir). The insect is a particularly important pest, one caterpillar causing defoliation damage in the case of about 300 pine or 1000 spruce needles during its development (Kolk & Starzyk, 1996).

Some researchers consider that the forest areas infested with nun moth *Lymantria monacha* are increasing, and outbreaks have become more frequent since the 19<sup>th</sup> century (Khanislamov et al., 1962). Grijpma (1989) provides data on outbreaks for the period 1972 – 1987, which show an expansion of the infested areas. Germany reported 305000 ha and Poland over 6.3 million hectares. In 1982, over 2.3 million hectares of forest areas were chemically treated, representing a quarter of the forest areas of Poland (Sliwa & Sierpinski, 1986). During the same period, in Germany, only 300 000 ha were chemically treated (Majunke et al., 1985; Alternkirch 1986).

The earliest attestations of the defoliator in our coniferous forests originate in the the the north of the country. There are reports from Zachar, Guzman and others (1901) stating that forests have been jeopardized by *Xylura monacha*. Professor Iacobescu (1927) wrote on the occurrence of this pest attack in 1893, in Ciuc district, in 1898 in Tarcău, in 1924 in Tulgheș and Moldovița, where a significant presence of this insect was registered on conifers, without any mention on the cases of defoliation (Mihalciuc 1988). A large outbreak of the nun moth *Lymantria monacha* occurred in Romania in the period 1953 – 1959, in the Borsec – Broșteni area, on conifers, and the total infected area was of 60420 ha.

In order to avoid defoliation of coniferous stands, chemical treatments have been performed, using airplanes and ground equipment, on 55,000 ha (Mihalciuc et al., 2000).

## MATERIAL AND METHOD

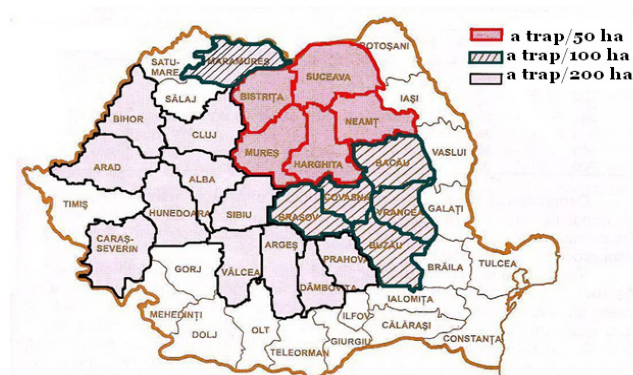


Fig. 1 - Network of pheromone traps

The aim of the study was the control of *Lymantria monacha* L. populations, in various stages of development. A series of aspects have been analyzed, such as insect detection, duration and dynamics of the flight, the color of the wings, as an important qualitative element of outbreaks prognosis and the activity of insectivorous birds, whose contribution to reducing density is unquestionable.

The defoliator was monitored in the entire forest area with stands of conifers and mixture with beech, regardless of the nature of the property (Figure 1). According to the instructions, pheromone traps density is of 1/50 ha, 1/100 ha and of 1/200 ha, depending on the vulnerability of the area to gradations (Order 454/2003).

Detection was performed by using moth sex pheromone (Atralymon – synthesized by the Institute of Chemistry Raluca Râpan – Cluj), approved exclusively for *Lymantria monacha*. Depending on the number of captures, insect egg and larvae detection in different stages can continue or not. In order to make an identification by adults, panel traps have been used, with glue on one side (30 x 40 cm), located on trees, at a height of 1.8 to 2.1 m, which have been placed in the forest monitoring system of spruce, fir or beech forest mixture of these species, where resinous trees contribute with more than 30%, regardless of the age of the trees. For afforested areas, up to 800 m altitude, the date of traps installation must not be later than July 1<sup>st</sup>, between 800-1400 m not later than July 6<sup>th</sup>, and for the areas of over 1400 m starting from July 11<sup>th</sup>.

Traps control was performed starting with their installation, until the end of the flight period (mid September). Traps have been checked in the field every 4-7 days, and captured adults have been recorded continuously, registering the wing hue of males. Gradation assessment must be made only after the control in the egg and larvae stages.

When a pheromone trap captures from 200 to 500 males in stands younger than 60 years, and from 500 to 1000 males in stands over 60 years, in the following year, the insect is identified in larvae stage and the number of pheromone traps is doubled (Order 454/2003).

## RESULTS AND DISCUSSIONS

Annually, in the detection activities carried out within the stands of spruce, fir and beech mixed forest, in both state (National Forest Administration - Romsilva) and private forests owners, traps have been installed in numbers varying from one year to another, from 24.787 in 2001, to 16.410 in 2009, and 489.771 (2001) to 689 249 (2009) moths have been captured during the flight period.

In the Eastern Carpathians, including the county forest administrations of Suceava, Neamț, Bacău, Harghita and Mureș, significant outbreaks have been registered in the past, and traps have been set in a dense network (1 trap/50 ha). A total number of 12.263 traps have been set in the forest and the largest number of *Lymantria monacha* moths captured have been registered (600.700 males), resulting in an average of 48.98 adults / trap (3% higher than last year). The surface on which the defoliator was found in latency in this area was estimated at 613 150 ha, in 2012 (Table 1).

In the adjacent area to the above mentioned one, including the county forest administrations of Baia Mare, Bistrița-Năsăud, Covasna and Focșani, 959 pheromone traps have been set (with a density up to a trap/100 ha), and a total

number of 25.128 moths have been captured, resulting in an average of 26.2 males/ trap (22% more than in the previous year). The surface where the defoliator was found in latency in this area was estimated at 95000 ha for 2012.

In other county forest administrations – Ploiești, Pitești, Vâlcea, Deva, Sibiu, Alba, Caraș - Severin, Cluj and Oradea, traps (2005 units) have been set in a sparse network (one trap/200 ha.), and 47.840 adults have been captured, scoring an average of 23.8 males/trap, 34% higher than the number recorded in the previous year. The area on which the insect was found is of about 401.000 ha. Overall, *Lymantria monacha* has been identified on an area of 1.110.050 ha.

In 2012, 15793 panel traps for tracking have been installed, and 690 489 moths have been collected during the flight period, resulting in a national average of 43.72 males per trap, a higher number than in 2011 (40.8 males/trap).

Table 1

Catches of *Lymantria monacha* pheromone traps (Atralymon) in 2012

County forest administration	No. of trap installed	No. of males captured <sup>xx)</sup>	Average number	Maximum number	Location		
					O.S.	U.P.	u.a.
Suceava	5672	241630	42,6	180	Broșteni	VIII	95A
Neamț	3073	153595	50,2	79	Poiana	VI	92C
Bacău	797	35012	44,7	161	Moinești	II	61A
Mureș	1545	75378	58,0	104	Fâncel	II	73 A
Harghita	1176	95085	80,85	500	M.Ciuc	IX	1D
Covasna	185	7255	39,2	266	Comandău	VI	105 B

The inventory of annual males captured in pheromone traps allowed keeping track of the population development in the last 37 years in Romania (Figure 2). Following the diagram of the captures, at large, we can notice fluctuations in the levels of population. During the intervals 1979, 1984-1985, 1988, 1990, 1993-1996 and 1999-2000, an increase in the level of population was registered; in the interval 2001-2002, we can notice a clear decrease in this level (of approximately 40%, comparative to the year 2000). In 2003, there was an increase in the level of *L. monacha* population, in the entire area of conifers, of 1.6, comparative to 2002, and, also, in the last 4 years, we can notice a clear tendency of increase in the levels of captures. A change in the level of captures, per decade, during the flight period, from 2000 to 2012, is illustrated in Table 2. There is a similarity in these changes in 2000, 2003, 2007, 2008 and 2009, when there was a concentration of captures in the last decade of July and the first decade of August. In 2001, 2002, 2004, 2005, 2006, 2010 and 2011, we can generally notice a shift and a higher concentration of these captures in the decades I - III of August.

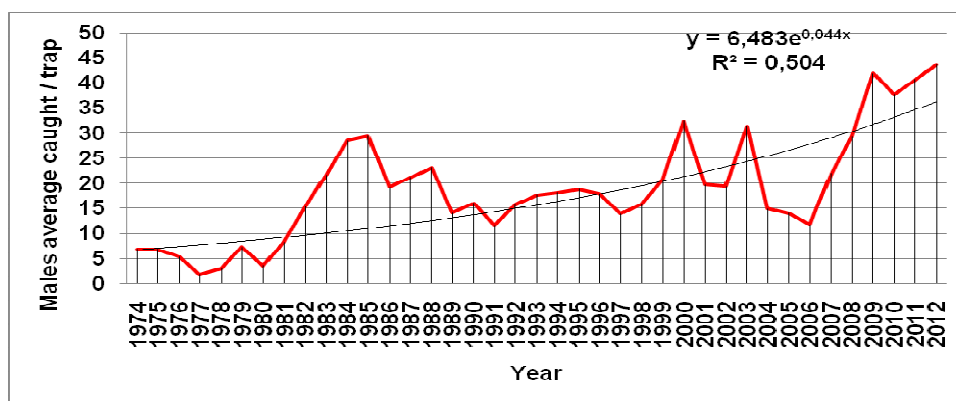


Fig. 2 - *Lymantria monacha* average captures in Romania

Table 2

Decades variations of catch (%) at *Lymantria monacha* pheromone traps

Year	July			August			September		
	I	II	III	I	II	III	I	II	III
2000	0,0	8,2	39,9	30,0	6,2	2,4	0,0	0,1	0,0
2001	0,0	0,1	15,5	34,4	25,3	12,5	3,9	0,0	0,0
2002	0,0	1,4	31,0	31,7	22,3	13,2	0,5	0,0	0,0
2003	4,3	14,8	30,5	25,4	15,2	4,6	2,3	0,1	0,0
2004	0,0	0,0	16,6	23,5	36,0	16,2	6,9	0,7	0,0
2005	-	0,0	4,1	39,6	31,0	20,6	3,7	1,0	0,0
2006	0,0	0,4	6,0	58,1	21,3	11,0	3,2	0,0	0,0
2007	0,0	42,3	36,3	12,0	6,6	2,4	0,3	0,1	0,0
2008	-	10,5	34,7	30,0	20,2	4,1	0,4	0,1	0,0
2009	-	2,4	28,6	16,7	27,5	19,2	5,6	0,0	-
2010	-	3,5	25,3	30,0	32,5	5,7	2,8	0,2	-
2011	-	7,5	26,8	23,7	21,1	10,4	8,6	1,7	0,2
2012	8,8	25,1	38,3	18,9	4,6	4,2	0,1	-	-

## CONCLUSIONS

1. The monitoring of *Lymantria monacha* is necessary in order to track and study the dynamics of the defoliator population in Romania. Thus, we can make a more accurate estimation of the outbreak occurrence.

2. This year (2012), adults' flight began in the second decade of July, sometimes sooner or later, depending on local conditions and forest site. Flight activity took place mostly in July and during the first half of August, when 80-90% of all adults were captured.

3. In the last 4 years, we can notice a clear tendency of growth in the average number of moths captured, by using glue panels for monitoring.

4. Insectivorous birds score a 25-30% reduction in the density of male adults captured on glue panels and equipped with pheromone lures.

5. Based on field observations, in 98% of cases, butterflies with light colored wings have been captured, and this demonstrates that the insect is in the latent period.

6. Maintaining a network of pheromone traps in the country, in forest areas belonging to owners outside the National Forest Administration – Romsilva is extremely important, given the level of danger of the pest *Lymantria monacha*.

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