

APPLICATION OF PROCEDURES FOR PEST DENSITY MONITORING IN THE PUBLIC GARDENS FROM THE REPUBLIC OF MOLDOVA AND ROMANIA

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Abstract. During the year 2013 under the bilateral project of the Institute of Genetics, Physiology and the Plant Protection Institute of the Academy of Science of Moldova, together with scientists from Romania from Forest Research and Management Institute, Craiova Research Station and partners from the University of Agricultural Sciences and Veterinary Medicine from Timișoara (Romania), there was conducted a series of studies. There were monitored and mass captured Lepidoptera insect species (*Tortrix viridana* L., *Helicoverpa armigera* Hb., *Grapholitha molesta* Br., *Grapholitha funebrana* Tr., *Laspeyresia pomonella* L., *Cameraria ohridella* Deschka & Dimic, *Lymantria dispar* L.) using pheromone traps in the Botanical Garden and public parks of the Republic of Moldova and Romania. Monitoring and mass capturing of the males of main pest species using pheromone traps allow us to apply other biological methods of plant protection.

Keywords: protection, efficacy, pests, pheromone, monitoring.

Rezumat. Aplicarea procedurilor de monitorizare a densității dăunătorilor în grădinile publice din Republica Moldova și România. Pe parcursul anului 2013 în cadrul proiectului bilateral al Institutului de Genetică, Fiziologie și Protecție a Plantelor al Academiei de Științe a Moldovei, împreună cu cercetători din România de la Institutul de Cercetări și Amenajări Silvice Craiova și partenerii de la Universitatea de Științe Agricole și Medicină Veterinară din Timișoara (România), s-au efectuat o serie de cercetări, conform tematicii proiectului cu ajutorul capcanelor feromonale în Grădina Botanică și Parcurile din Republica Moldova și România. Monitorizarea și capturarea în masă a masculilor a principalelor specii de dăunători (Lepidoptera), *Tortrix viridana* L., *Helicoverpa armigera* Hb., *Grapholitha molesta* Br., *Grapholitha funebrana* Tr., *Laspeyresia pomonella* L., *Cameraria ohridella* Deschka & Dimic, *Lymantria dispar* L. cu ajutorul capcanelor feromonale au permis să se aplice metoda biologică de protecție a plantelor.

Cuvinte cheie: protecție, eficacitatea, dăunători, feromon, monitorizare.

INTRODUCTION

Scientists involved in the IMPACT project investigate new natural methods for pest control in forests and public parks which are subjected to climate changes. In a changing world, strongly affected by recent anthropogenic impact and climate change, international cooperation is a key element of a joint effort aimed at reducing and halting biodiversity loss. This situation is reflected in the book "The impact of environmental factors on biodiversity" (2010). Also in this source, it is indicated that 15589 species of plants and animals are threatened with extinction, 45% of the Earth forests have disappeared, 10% of coral reefs in warm areas are already dead (MAICAN, 2010). This project is an imperative of the time, influenced by the necessity of environmental protection with alternative methods to chemical ones (biologically active substances and entomophages), (GAVRILIȚA, 2005; KNUTSON, 2001; OZTEMIZ et al., 2009; LENTEREN, 2000). This problem was discussed in the bilateral cooperation in scientific research, technological development and innovation Program between the National Authority for Scientific Research of Romania and the Academy of Sciences from Moldova. During 2013 year, within the bilateral program, the Institute of Genetics, Physiology and Plant Protection ASM, together with scientists from Forest Research and Management Institute (Craiova) and partners from the University of Agricultural Sciences and Veterinary Medicine from Timișoara (Romania), conducted a series of researches in this specific area.

Chemical use in the parks from Moldova and Romania leads to environmental conditions worsening. The processes and methods of protection proposed in this current project are an imperative of time and meet current requirements to improve the environmental conditions. It is known that a complex of pests attack plants in parks (MIHAILOV, 2005). The consequences can be felt upon the decorative plants from the parks which lose their attractiveness for the visitors. It is also to consider that chemical treatments are prohibited in the public areas because of the negative influence on human health.

The team of scientists involved in this project has extensive experience in pests risk monitoring and analysis, both for phytophages and entomophages application in pest control. The initial efforts were focused especially on a complex of moths, Cabbage Butterfly, Cabbage Moth - that are the most widespread pests in the parks from Moldova and Romania. In recent years, big steps have been made for large-scale application of integrated biological control as a general use, but little was focused on biological crop protection in the forest and parks. Insect population dynamics is influenced by both biotic and abiotic factors.

The purpose of research is the use of biologically active substances (sex pheromones) as means of monitoring the defoliating insect species in the public parks from Moldova and Romania.

MATERIALS AND METHODS

Methods for detection and prognosis of pest insect species and density in parks.

Lymantria dispar Linnaeus 1758 (hairy caterpillar oak) is one of the pests with a very high potential of rearing and spreading, being one of the most dangerous pests with a high risk of attack. Coefficient for population density increase has different values from one year to another. Presence report of the defoliator is performed in all stages during its development (adults, eggs, larvae and pupae), whereas the detection of the infested areas is performed by analysing the number of clutch and larvae. An area is considered infested if it detects more than one clutch at 50 trees. The evidence period of the clutch starts from September to April the following year. Detection was performed by analysing the clutch presence at 10 to 20 trees per plot on diagonal area.

Tortrix viridana Linnaeus 1758 (green oak moth). The monitoring of the current species was performed in the Imago stage using pheromone traps. The traps were placed in oak trees at a height of about 2.0 m above the ground. The distance between the traps themselves was not less than 50 m, one from another. Evidence was carried out once in 7 days. Captured material was then removed from the traps.

Grapholitha funebrana Treitschke 1835 (worm plum) and *Grapholitha molesta* Busck 1916 (oriental worm) were monitored in plum cultures with the use of pheromone traps. Pheromone traps were placed at a height of 2.0 m above the ground on plum trees. Distance between traps set for one species was not less than 50 m. Evidence for number of males captured in the traps was taken every 7 days. Pheromones providers were replaced once in a generation. Adhesive supports were replaced when needed. Analysis was performed at the egg stage on 100 fruits per tree.

Laspeyresia pomonella Linnaeus 1758 (codling moth). Monitoring was conducted on apple culture with pheromone traps. Pheromone traps were placed on the trees at a height of 1.5 m from the ground. Distance between traps was about 50 m. Captured males record in traps was performed once every 7 days. Captured males were removed afterwards. Pheromones providers were replaced every 30 days. Adhesive substrates were replaced as needed. Records were taken in the egg phase on the fruits.

Cameraria ohridella Deschka & Dimic 1986 (chestnut miner moth). Monitoring was conducted in chestnut plantations through pheromone traps placed at a height of about 2.0 m from the ground. Distance between traps was about 50 m. Records for captured males was performed once a week. Pheromone providers were replaced once every 30 days but supports with entomological glue were replaced every record.

Helicoverpa armigera Hübner 1809 (cotton bollworm). Monitoring was conducted on plots with decorative flower species using pheromone traps placed on wooden stands at a height of 1.0 m from the ground. Distance between traps was around 50 m. Records on captured males were taken regularly (every 7 days). Pheromone providers were replaced once a generation and the adhesive backing - as needed.

Pheromone traps were used for recording and monitoring defoliating insect species, which threaten forests and ornamental crops in the parks from Moldova and Romania. To monitor defoliating insect species across the Botanical Garden (Institute of Botany ASM), pheromone traps were placed in a number of cultures (mulberry - *Morus alba*, Oak - *Quercus pedunculiflora*, Plum - *Prunus cerasifera*, Apple - *Malus domestica*, Chestnut - *Aesculus hippocastanum* and a collection of decorative flowers). There have been set a number of 37 pheromone traps for monitoring the following pest species: *T. viridana* - green oak moth, *H. armigera* - cotton bollworm, *G. funebrana* - plum worm, *G. molesta* - Oriental worm, *C. ohridella* - chestnut miner moth, *L. dispar* - hairy caterpillar of the oak. Records on the number of males captured in pheromone traps were regularly performed (once every 7 days) from May 20 up to September 3, 2013.

RESULTS AND DISCUSSIONS

Data analysis showed that most males were captured during the research in pheromone traps placed at the chestnut plantations *C. ohridella* - 24762 males. In other cultures, the number of captured males decreases. Such as: plum - *G. funebrana* - 1467 and *G. molesta* - 1492; apple - *L. pomonella* - 657; decorative flower species - *H. armigera* - 461; Oak - *L. dispar* - 105 males; Oak - *T. viridana* - 99 males. Monitoring and mass capturing of the males of main pest species using pheromone traps allow us to apply other biological methods of plant protection. All along, the huge number of males captured in pheromone traps placed at chestnut culture, showed us eloquently the deplorable condition of trees attacked by the pest *C. ohridella*.

During the vegetation period, at the Botanical Garden (Institute of Botany of the Academy of Sciences) pheromone traps were also used to decrease pest population density (with mass male capturing method). Data showed that the number of captured pest *L. dispar* (at Oak) ranged from 1 to 23 males/trap with an average of 2.2 males/trap. The pest *T. viridana* (at Oak) ranged from 1 to 38 males/trap with an average of 2.0 males/trap. The pest *G. funebrana* (plum) ranged from 26 to 170 males/trap with an average of 30.50 males/trap. The capture of the pest *G. molesta* (plum) ranged from 19 to 177 males/trap with the average of 31.1 males/trap. *L. pomonella* (apple) ranged from 7 to 69 males/trap (average - 31.6 Males/trap). Capturing the pest *C. ohridella* (chestnut) ranged from 95 to 22.261 males/trap (average - 515.8 males/trap). *H. armigera* (decorative flower species) ranged from 2 to 75 males/trap (average - 9.6 males/trap). Table 1, Fig. 1.

Table 1. Number of males captured in pheromone traps during the research based on the crop species and pest species (Botanical Garden, Chișinău, 2013).

Pest species / Cultures	Total number of males captured with pheromone traps	Average male number captured per trap
<i>Lymantria dispar</i> (Oak)	105±4.5	2.2±0.2
<i>Tortrix viridana</i> (Oak)	99±3.8	2.0±0.1
<i>Grapholitha funebrana</i> (Plum)	1467±5.2	30,5±2.2
<i>Grapholitha molesta</i> (Plum)	1492±5.9	31.1±1.9
<i>Laspeyresia pomonella</i> L (Apple)	657±5.2	31.6±1.2
<i>Cameraria ohridella</i> (Chestnut)	24762±7.2	515.8±3.2
<i>Helicoverpa armigera</i> (decorative flowers)	461±4.2	9.6±1.2

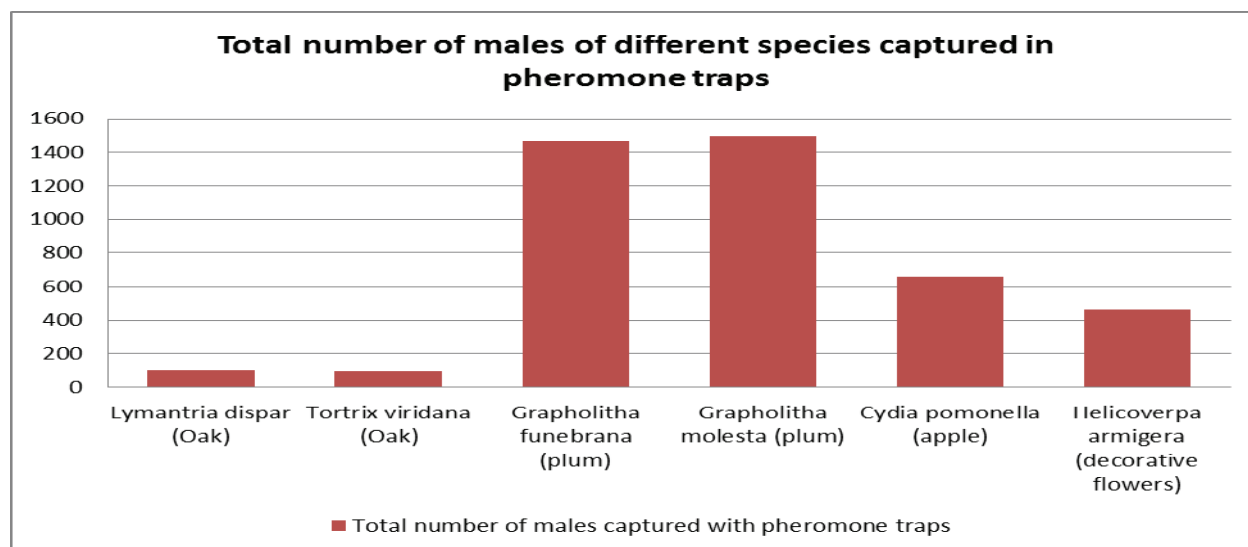


Figure 1. The number of males captured in pheromone traps during the research period at the Botanical Garden from Chișinău, 2013.

In the parks from Craiova and Timișoara (Romania), monitoring and mass capturing of the main pest species was conducted from the 24th of July till the 2nd of August 2013. Experiments have taken place in several areas of Craiova, such as: the Botanical Garden, Alley ICAS, Romanescu Park and Youth Park, as well as Timișoara: ICAS and USAB Park. Pheromone traps were placed in plots on 6 different species of trees: mulberry - *Morus alba*, Oak - *Quercus pedunculiflora*, Plum - *Prunus cerasifera*, Apple - *Malus domestica*, Chestnut - *Aesculus hippocastanum*, Plane - *Platanus acerifolia* and decorative flower species. In total 35 pheromone traps were placed to monitor the following pest species: *H. cunea*, *G. funebrana*, *C. ohridella*, *H. armigera*, *L. dispar*.

As a result of the research data analysis it has been demonstrated that most males were captured in pheromone traps placed on chestnut trees during the research period. In this way, for the species *C. ohridella*, on average, 93 males per trap were captured in the USAMVB Park and Central Park from Timișoara and 54 males at ICAS Alley from Craiova. In plum culture, the *G. funebrana* species was captured, on average, 43.0 males/trap in the Botanical Garden from Craiova and 19.0 males/trap in Romanescu Park. The pest species *C. ohridella* (chestnut) was captured on an average of 19.0 males/trap in Romanescu park from Craiova. In the parks of Timișoara and Craiova, *G. funebrana* pest species (plum) was captured on an average of 14.0 to 17.0 males/trap (USAB Park, Youth Park). In chestnut culture there were captured an average of 12.0 males per trap of pest *C. ohridella* in ICAS, Timișoara and 12 males/trap in Youth Park, Craiova. The pest species *L. dispar* (Oak) was captured on average number of 8.0 males/trap in Youth Park from Craiova. The pest *H. armigera* (decorative flowers) was captured on average of 7.0 males/trap in ICAS, Timișoara. *L. dispar* (Oak) has been captured on average number - 6.0 males/trap in ICAS, Timișoara and at plane culture - 5.0 males/trap in the Botanical Garden, Craiova. Pest species *L. dispar* (Oak) has been captured on an average of 4.0 males/trap (Botanical Garden, Craiova) and the species *H. cunea* (mulberry) – around 1 male/trap.

In this way, it was found that monitoring of pests using pheromone traps allows us to obtain very useful information for plant protection through biological means. It has been shown that both in Romania and the Republic of Moldova, chestnut species were the most attacked species by the pest *C. ohridella*. The obtained results are shown in Figs. 2, 3. In the Fig. 4-9 images of research objects are present in various stages of development of pests.

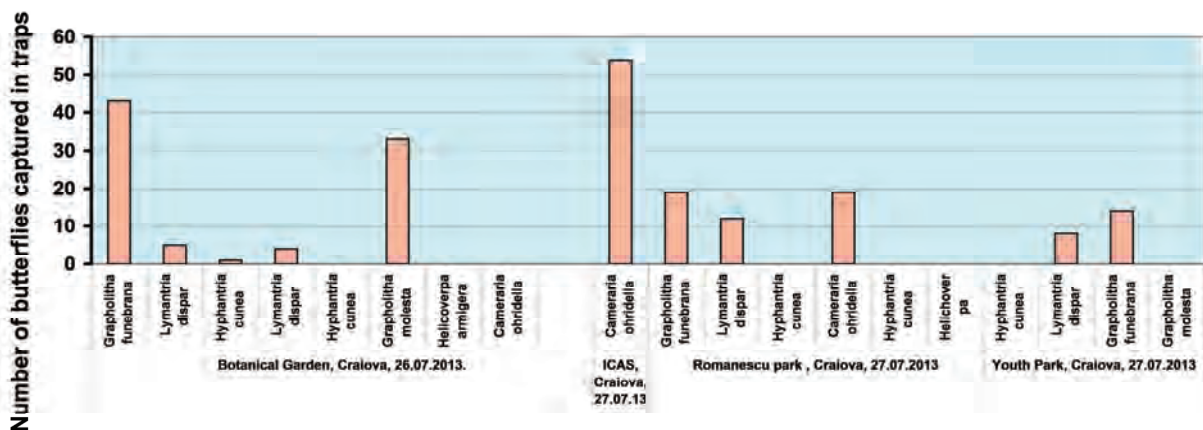


Figure 2. Number of butterflies captured in traps from Craiova parks, Romania, 2013.

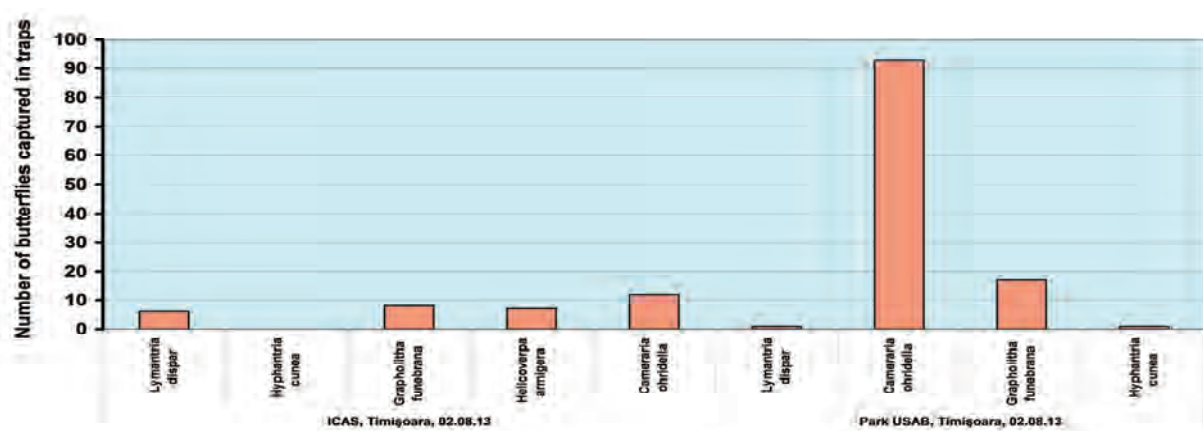




Figure 3. Number of males captured in traps - ICAS and USAB, Timișoara, Romania, 2013.



Figure 4. Male adults of *Grapholitha funebrana* trapped in plum cultures, 2013 (original).



Figure 5. Male adults of *Lymantria dispar* trapped in oak culture, 2013 (original).

	
<p>Figure 6. A nest of caterpillars on mulberry <i>Hyphantria cunea</i> Drury, 1773 (attacking), 2013 (original).</p>	<p>Figure 7. <i>Cameraria ohridella</i> adult on chestnut, 2013 (original).</p>
	
<p>Figure 8. Larvae of <i>Cameraria ohridella</i> on leaves of chestnut, 2013 (original).</p>	<p>Figure 9. Pupa of <i>Cameraria ohridella</i> on a chestnut leaf, 2013 (original).</p>

CONCLUSIONS

1. During the project year 2013, expeditions were conducted in different areas of the Republic of Moldova and Romania, for monitoring and phytosanitary control of the parks to commonly fulfil the project.
2. As a research result there were highlighted and monitored defoliating insect species (Lepidoptera - *Tortrix viridana* L. oal green moth, *Helicoverpa armigera* - corn earworm, *Grapholitha funebrana* - Plum Fruit Moth, *Grapholitha molesta* - Oriental Fruit Moth, *Laspeyresia pomonella* - codling moth, *Cameraria ohridella* - chestnut leaf miner, *Lymantria dispar* L. - European gypsy moth) and determining outbreaks, which represent high danger to cultures, using pheromone traps in the Botanical Gardens and parks from the Republic of Moldova and Romania.
3. There were developed methods for monitoring the density of the defoliating pest population, by applying biologically active substances (sex pheromones), as well as by signalling development dynamics of one generation of pests in the parks.

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