PhD THESIS

(SUMMARY OF PhD.THESIS)

Research regarding pests from some landscaping in the central area of Oltenia

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SUMMARY

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In recent years, green spaces have begun to face more and more pests of dendrofloric plants, either monophagous or polyphagous, causing considerable damage by changing the microclimate in those areas, directly affecting the host plants and lowering the aesthetic value of them.


The paper presents research activities carried out to obtain new information related to the current state of pests and their distribution in urban ecosystems and to find the best methods of control thus limiting their spread.

The thesis is structured in 7 chapters and contains a number of 113 figures, 68 original photographs and 37 graphics and a total of 62 tables.

Chapter 1. CURRENT STATE OF RESEARCH ON PESTS IN SOME LANDSCAPE ARRANGEMENTS IN THE CENTRAL AREA OF OLTENIA, presents data from the literature on the main species found in landscape arrangements in Craiova area: *Macrosiphum rosae* L., *Nezara viridula* L., *Cameraria ohridella* Deschka & Dimić, *Cydalima perspectalis* Walker and *Metcalfa pruinosa* Say, data on the global spread of these species, data on morphology, ecology, host plants and prevention and control measures.

Chapter 2. Objectives of research: In order to reduce the population of the species studied, it is necessary to establish strategies to prevent and control pests, which consist of introducing new methods to reduce the harmful effects of chemical treatments on humans and the environment.

➢ Climatological analysis of the studied area in the period 2018-2021;
➢ Monitoring of harmful species encountered in landscaping in Craiova;
➢ Monitoring the biological cycle and ecology of *Cydalima perspectalis* Walker;
➢ Integrated control of *Cydalima perspectalis* Walker and *Metcalfa pruinosa* Say species.

Chapter 3. Particularities of the natural environment where the experiment took place contain the geographical location and the general characterization of the central area of Oltenia, the Botanical Garden „Al. Buia” and Nicolae Romanescu Park in Craiova, the place where the research activities were carried out.
Chapter 4. Materials and methods: During the research period, specific methods of entomology were used to carry out the experiments, adapted to the conditions of the experimental years. There are presented methods for monitoring the climatic conditions from 2018-2021, of harmful species, adults and developmental stages, the biology and ecology of *Cydalima perspectalis*, of biocombating with pheromone traps of *Cydalima* species, purchased from the Institute for Chemistry "Raluca Ripan" in Cluj Napoca, using a local variant: Cydalima perspectalis and three pheromone variants offered for testing, chemical control of *Metcalfa* species with chemicals based on spirotetramate, chlorantraniliprol, tau-fluvalinate, lambda-cyhalothrin, cypermethrin-chlorpyrifos.

Chapter 5. Results and discussions: includes 5 subchapters, 17 sub-subchapters and 6 sub-subchapters with results on the climatological analysis of the area, monitoring of pests encountered in green spaces in Craiova, biological cycle, ecology and biological control of *Cydalima perspectalis* and chemical control of *Metcalfa pruinosa*.

5.1. Results regarding climatological analysis of the Craiova area in the period 2018-2021, includes 5 sub-chapters.

In the analysis of the climatic factors of the Craiova area, the multiannual monthly averages for the period 1981-2017 were calculated, and for the period 2018-2021 the temperatures, the rainfall and hygrometric decadal, monthly and annual regimes were calculated. The average annual temperature was 12.3°C in 2018, 15.9°C in 2019 and 13.9°C in 2020, compared to the multiannual average from 1981-2017 which was 11.5°C. The maximum annual temperature was 18°C in 2018, 19.1°C in 2019 and 18.8°C in 2020, and the maximum multiannual temperature in the period 1990-2017 is 25°C. The minimum annual temperature increased compared to 1990-2017 by 7.5°C in 2018, 8°C in 2019 and by 7.7°C in 2020.

The annual amount of precipitation was 785.3 mm in 2018; 527.8 mm in 2019 and 500.1 mm in 2020, and the multiannual amount of precipitation in the period 1990-2017 was 596.8 mm. Atmospheric humidity values are 75.0% in 2018, 71.4% in 2019 and 69.6% in 2020.

5.2. Results regarding the monitoring of harmful species found in some landscape arrangements in Craiova area, includes 6 sub-subchapters and 2 sub-sub-subchapters containing information about host plants, how to attack, damage and monitoring of adults (*Cydalima perspectalis*)
5.2.3. Results obtained of monitoring of the species Halyomorpha halys Stål

Different stages of development of the species *Halyomorpha halys* Stål were found in the green spaces from Craiova on a number of 32 host species belonging to 18 botanical families (fig.1)

![Fig. 1. Larvae of the fifth age on the leaf of Amorpha fruticosa L. (left) and larvae feeding on Wisteria sinensis (Sims) DC. (right)(original)](image)

5.2.5. Results obtained regarding the monitoring of the species Cydalima perspectalis Walker (2 sub-sub-subchapters).

In the period 2019-2021, four pheromone variants proposed for testing were used for adult monitoring. This type of monitoring is used both in biological control, but especially in the accurate estimation of the number of generations, the flight activity of adults and the dynamics of the species (fig.2).

![Fig. 2. The dynamics of adults of the species Cydalima perspectalis according to generation in 2020](image)
The adult flight curve of *Cydalima perspectalis* during 2020 showed three activity peaks, specific to the hibernating generation (May 18-June 25), the first generation (July 20-August 25) and the second generation (September 7 and October 14).

5.2.6. Results obtained regarding the monitoring of *Metcalfa pruinosa* Say

Following the research carried out in the Botanical Garden „Al. Buia “and Nicolae Romanescu Park, the presence of the pest was reported on a total number of 117 species, belonging to 51 botanical families (fig.3).


5.3. Monitoring of the biological cycle of species *Cydalima perspectalis* Walker

In natural field conditions, the number of generations of the species *Cydalima perspectalis* can vary from a year to another, in 2019, in field conditions the box tree moth has developed 3 complete generations, and the fourth generation was partial. The biological activity of the species took place between March 8 and November 18, 2019, for 255 days.
In 2020, the biological activity was between 12.03-17.10.2020, totaling a number of 219 days, being 36 days shorter than 2019, so the species *Cydalima* completed only two generations, and the third generation is partial, and in 2021 until the present time of research *Cydalima perspectalis* presented a complete generation, and the second is evolving.

5.4. Results obtained on the ecology of the species *Cydalima perspectalis* Walker

During the researches from 2019-2021, it can be seen that the number of generations of *Cydalima perspectalis* are correlated with climatic conditions (fig.4), so the relationship between climatic conditions and the development of generations in 2019-2020 is weakly positive in relation to the average temperature, moderately positive in relation to precipitation and moderately negative in relation to atmospheric humidity.

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**Fig. 4. Dynamics of climatic conditions during the evolution of the biological cycle in 2020**

The sum of the effective temperature necessary for the development of the egg stage in the period 2019-2021 varies between 48.6°C and 62.8°C, the values necessary for the evolution of the larval stage vary between 403.4°C and 444.8°C, and for the stage of stern, the amount of effective temperature varied between 133°C and 139.1°C.

5.5. Results regarding the integrated combating of *Cydalimaperspectalis* Walker and *Metcalfa pruinosa* Say, include 2 sub-subchapters and 1 sub-sub-subchapter.

5.5.1. Results regarding the biocombating of species *Cydalima perspectalis* Walker with the aid of attracting pheromones.

Figure 5 shows graphically the variation of adults captured in the period 2018-2021. In 2018, under the influence of the climatic conditions from July to December (14.1°C average temperature, precipitation of 370.6 mm and humidity of 73.6%), with the aid of
attracting pheromones, a number of 102 males were captured with V2, followed by V1 = 88 males, V3 = 87 males and 29 males with the variant Cydalima perspectalis.

From the data recorded in 2019, the number of catches was influenced by the action of climatic conditions during the year (average temperature of 13.4 °C, rainfall of 429.4 mm and atmospheric humidity of 68%), so the most attractive pheromone was pheromone V2 = 299 captured males, followed by V3 (293) and V1 (210), the variant Cydalima perspectalis registering a lower number of catches (122 males) than the other three variants.

Under the action of climatic factors in 2020 (13.9°C average temperature, 500.1 mm precipitation volume and 69.7% atmospheric humidity), a number of 160 males / V2, 157 males / V1 were captured, 153 males / V3 and 66 males / Cydalima perspectalis.

In 2021 under the influence of climatic conditions this year, (January-August) 13.4°C average temperature, 429.4mm of rainfall and 68% atmospheric humidity, were captured with V1 = 121 males, V2 = 129 males and V3 = 108 males.

![Graph showing the variation of catches recorded in the period 2018-2021 using tested pheromones.](image)

**Fig.5. Variation of catches recorded in the period 2018-2021 using tested pheromones.**

The dependence between the number of captured adults in 2019 and the temperature is moderately positive ($r = 0.45$), between the number of captured adults and precipitation there is an insignificantly negative correlation ($r = -0.04$), and between the number of captured adults and atmospheric humidity a moderately negative correlation ($r = -0.34$) (fig.6).
The number of catches is influenced, firstly, by the attractiveness of the pheromone, then by the abundance of the population and the climatic conditions, so the correlation between the two variables, number of catches and average temperature is moderately positive for each year of research.

5.5.2. Results obtained regarding the testing of some insecticides in the chemical control of Metcalfa pruinosa Say

Following the treatments carried out in the research years 2018 and 2019 and the monitoring of their effect on the pest Metcalsa pruinosa Say according to the mortality of larvae and adults, we found that, of the five insecticides used, the best results were recorded for Nurelle D 50/500 EC whose effect could be observed 24 hours after its application, followed by the products Karate Zeon and Mavrik 2F (table 1).

The Coragen product obtained a different efficacy against larvae 14 days after the application of the treatment of 83.9% in 2018 and 92.5% in 2019, in the case of adults the percentage of efficacy according to their mortality varied between 53.1% (2018) and 100% (2019).

The weakest results were obtained for the Movento treatment variant, the percentage of effectiveness depending on the mortality of larvae varied between 59.6% (2018) and 64.7% in 2019, that of adults between 45.3% in 2018. In 2019, the number of adults was constantly increasing throughout the monitoring of the two weeks.
### Table 1

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<tr>
<th>Nr. Crt.</th>
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<th>Forme mobile/Mobile forms</th>
<th>Conc. %</th>
<th>EFIC % 2018</th>
<th>EFIC % 2019</th>
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<tbody>
<tr>
<td>1</td>
<td>Nurelle D 50/500EC (Cipermetrin+ clorpirifos)</td>
<td>LARVE</td>
<td>0,5</td>
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<td>100</td>
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<td></td>
<td>ADULȚI</td>
<td></td>
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<td>100</td>
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<tr>
<td>2</td>
<td>Movento 100 SC (spirotetrama)</td>
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<td>59,6</td>
<td>64,7</td>
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<td></td>
<td></td>
<td>ADULȚI</td>
<td></td>
<td>45,3</td>
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<tr>
<td>3</td>
<td>Coragen (chlorantraniliprol)</td>
<td>LARVE</td>
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<td>92,5</td>
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<td></td>
<td>ADULȚI</td>
<td></td>
<td>53,1</td>
<td>100</td>
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<tr>
<td>4</td>
<td>Mavrik 2F (Tau-flualinat)</td>
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<td>ADULȚI</td>
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<td>100</td>
<td>100</td>
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<tr>
<td>5</td>
<td>Karate Zeon (lambda-cihalotrin)</td>
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<td>ADULȚI</td>
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**Chapter 6. Conclusions and recommendations**, contains 6 subchapters and contains the conclusions and recommendations obtained from the research.

**Chapter 7. Originality and innovative contributions of the thesis**, includes new and innovative contributions of the thesis.

**The bibliography** includes 244 bibliographic references consulted during the thesis.

The work is structured in 7 chapters and contains a number of 113 figures, 68 original photographs and 37 graphics and a total of 62 tables.

The list of tables (62 tables) and figures (113 figures) inserted in the sentence are given in *Annex I* and *Annex II*. 