ABSTRACT

Monitoring and control of pests affecting the dendroflora in urban areas

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Dendroflora plant pests cause considerable damage, by decreasing plants decorative value and by altering the microclimate of urban areas. Changing climate conditions within the past few years, as excessive drought alternating with heavy rainfall and the massive trade increase, especially the import of ornamental plants, due to the increase of private urban green areas surfaces, have favoured the spreading of pests associated to decorative parks, as well as a increased aggressiveness of other species, manifested both by widening the host plants spectrum and by the severity of damage to the affected hosts.

The thesis presents the impact of pests on plant species commonly found in ornamental parks and gardens in urban areas, as well as the possibilities of controlling these pests, the fighting difficulties to preserve the landscape, all having as final aim the improvement of the life quality.

Throughout Europe, new pests spread rapidly and cause great damage to public and private landscaping. Trade in ornamental plants is the key factor in the introduction and spread of invasive insects in Europe.

The control of ornamental plant pests in urban green areas has a distinct specificity, as there are a number of challenges due to the functions of landscape inside the cities.

The thesis is structured in 6 chapters and contains 15 tables and 158 photos, out of which 147 are originals, as follows:

In **Chapter I,** *"The status of urban green spaces in Europe and Romania"*, information are given about the technical literature that focuses on the importance of urban green areas in order to improve the quality of human life by creating a suitable environment for outdoor relaxation, the beautification of localities, better living and working places, etc.

In **Chapter II,** *"The status of pests in ornamental parks and gardens"*, data on the implementation of sustainable development research programs through low risk practices on human health and the environment are presented. It also shows the level of damage to plants in landscaping after the pest attack.

Chapter III, *"Methods of monitoring pests in ornamental parks and gardens"* presents the techniques for monitoring harmful and beneficial fauna in urban landscape, the monitoring decisions, the pest control difficulties as well as possibilities for pest control

Chapter IV, *"Materials and methods"*, synthesizes the thesis purpose and objectives, the materials used and the methods related to the research program established through the theme of the doctoral thesis. Six locations for monitoring and pest detection were selected in the central and northern area of Bucharest (Cişmigiu Park, Herăstrău Park, Kiseleff Park, "Grădina Maicii Domnului" Park within the Patriarchal Residence, green spaces within UASVM Bucharest and a garden within a private residence). The methods of pest detection are grouped by systematic categories and some methods of control for few pests found are detailed (*Cydalima perspectalis* Walker, *Monarthropalpus flavus* Schrank, *Ardis brunniventris* Htg. și *Unaspis euonymi* Comstok), some cases having been experimented within one`s private garden.

Chapter V, *"Results regarding the detection and control of some ornamental plant pests"*, details those species of pests that have been identified following the monitoring process and the impact they incur on the dendroflora in the urban landscape. The presented material is accompanied by 147 original figures, suggestive of the pests found and the damage they produced. Between 2008 and 2017 there were found 61 harmful species belonging to 3 classes: *Arahnida*, *Insecta* and *Gastropoda.*

No.	***Species***	***Host plant***
	Arachnida, Acari	
1	*Tetranychus urticae* (Koch, 1836) [A, I]	*Tilia* sp., *Catalpa bignonioides, Catalpa speciosa, Hibiscus syriacus, Spiraea vanhouttei, Ligustrum vulgare, Phylladelphus coronarius, Crataegus* sp., *Campsis radicans, Rosa* sp.
2	*Eotetranychus tiliarum* (Hermann, 1804)	*Tilia cordata*
3	*Eriophyes tiliae var. rudis* Nal.	*Tilia tomentosa*
4	*Eriophyes tiliae tiliae* (Pgst., 1857)	*Tilia platyphyllos, T. cordata, T. tomentosa*

5	*Eriophyes tiliae exilis* Nal.	*Tilia platyphyllos, Tilia cordata*
6	*Eriophyes triradiatus* Nal.	*Salix alba, Salix tortuosa*
7	*Schizotetranychus cellarius* (Banks, 1917) [A]	*Phyllostachys aureosulcata*
Insecta, Homoptera		
8	*Trialeurodes vaporariorum* (Westwood, 1856) [A, I]	*Salvia* sp., *Pelargonium* sp., *Impatiens* sp., *Aquilegia* sp., *Petunia* sp.
9	*Tetraneura ulmi* (L.,1758)	*Ulmus* sp.
10	*Pemphigus spirothecae* (Passerini, 1860)	*Populus* sp.
11	*Unaspis euonymi* (Comstock, 1881) [A, I]	*Euonymus* sp.
12	*Aulacaspis rosae* (Bouché, 1833)	*Rosa* sp.
13	*Pseudaulacaspis pentagona* (Targioni Tozzetti, 1886) [A, I]	*Syringa vulgaris, Morus alba, Euonymus* sp.
14	*Aphis gossypii* (Glover, 1877)	*Catalpa bignonioides, Catalpa speciosa, Hibiscus syriacus*
15	*Gossyparia spuria* (Modeer, 1778)	*Ulmus* sp.
16	*Liriomyza* sp.	*Dahlia* sp.
17	*Pineus pini* (Macquart, 1819)	*Pinus strobus*
18	*Adelges piceae* (Ratzeburg, 1844) [A]	*Picea abies*
19	*Adelges abietis* (L., 1758) [A]	*Abies alba*
20	*Adelges laricis* (Vallot, 1836) [A]	*Larix decidua*
21	*Gilletteella cooleyi* (Gill., 1907)	*Pseudotsuga menziessi*
22	*Macrosiphoniella sanborni* (Gillette, 1908) [A]	*Chrysanthemum sp.*
23	*Aphis chrysanthemi* (Koch, 1854)	*Chrysanthemum sp.*
24	*Aphis ligustri* (Kalt., 1843)	*Ligustrum vulgare*
25	*Aphis spiraephaga* (F.P. Müller, 1961)[A, I]	*Spiraea × vanhouttei*
26	*Macrosiphum rosae* (L., 1758)	*Rosa* sp.
27	*Aphis craccivora* (Koch, 1854)	*Robinia pseudacacia*
28	*Prociphilus fraxinifolii* (Riley, 1879)	*Fraxinus americana*
29	*Pachypappa warshavensis* (Nasonov, 1894)	*Populus alba*
30	*Eriosoma lanuginosum* (Hartig, 1839)	*Ulmus* sp.
31	*Lepidosaphes ulmi* (L., 1758)	*Ulmus* sp.
32	*Pulvinaria hydrangeae* (Steinweden, 1946)	*Euonymus europaeus Fraxinus excelsior*
33	*Phyllaphis fagi* (L., 1767)	*Fagus sylvatica*
34	*Parthenolecanium corni* (Bouché, 1844)	*Lonicera japonica*

Insecta, Hemiptera		
35	*Halyomorpha halys* (Stal, 1855) [A, I]	*Rosa* sp., *Hybiscus syriacus, Syringa* sp., *Magnolia* sp., *Tilia* sp., *Cedrus* sp., *Pelargonium* sp., *Impatiens* sp., *Petunia* sp., *Vinca rosea, Hyacinthus orientalis*
36	*Corythucha ciliata* (Say, 1832) [A, I]	*Platanus* × *acerifolia*
37	*Metcalfa pruinosa* (Say, 1830) [A, I]	*Rosa* sp., *Hybiscus syriacus, Syringa vulgaris, Buxus* sp., *Tilia* sp., *Cornus* sp., *Parthenocissus* sp., *Forsythia* sp., *Ailanthus* sp., *Platanus* sp., *Salvia* sp., *Pelargonium* sp.
38	*Psylla buxi* (L., 1758)	*Buxus sempervirens*
Insecta, Lepidoptera		
39	*Cydalima perspectalis* (Walker, 1859) [A, I]	*Buxus sempervirens*
40	*Palpita vitrealis* (Rossi, 1794)	*Ligustrum vulgare*
41	*Cameraria ohridella* (Deschka și Dimic, 1986) [A, I]	*Aesculus hyppocastanum*
42	*Phyllonorycter platani* (Staudinger, 1870)	*Platanus* × *acerifolia*
43	*Hyphantria cunea* (Drury, 1773) [I]	*Acer negundo, Acer platanoides, Fraxinus excelsior, Morus alba, Populus* sp., *Betula pendula*
44	*Rhyacionia buoliana* (Denis și Schiffermüller, 1775)	*Pinus sylvestris*
45	*Autographa gamma* (L., 1758)	*Pelargonium* sp.
46	*Helicoverpa armigera* (Hübner, 1809)	*Rosa* sp., *Pelargonium* sp., *Gladiolus* sp., *Chrysanthemum* sp.
Insecta, Coleoptera		
47	*Byctiscus betulae* (L., 1758)	*Tilia* sp.
48	*Lilioceris lilii* (Scopoli 1763)	*Lilium candidum*
49	*Lytta vesicatoria* (L., 1758)	*Syringa vulgaris*
50	*Otiorhynchus sulcatus* (Fabricius, 1775)	*Rhododendron* sp. *Syringa vulgaris* *Euonymus* sp.
51	*Melasoma populi* (L., 1758)	*Populus* sp.
52	*Ovalisia festiva* (L., 1767)	*Thuja occidentalis*
53	*Semanotus russicus* (Fabricius, 1776)	*Cupressocyparis leylandii*
54	*Aphtona coerulea* (Fourcroy, 1785)	*Iris* sp.

Insecta, Hymenoptera		
55	*Ardis brunniventris* (Hartig, 1837)	*Rosa* sp.
56	*Megachile centuncularis* (L., 1758)	*Rosa* sp., *Syringa vulgaris*
57	*Arge ochropus* (Gmelin, 1790)	*Rosa* sp.
58	*Cladius pectinicornis* (Geoffroy, 1785)	*Rosa* sp.
59	*Tomostethus nigritus* (F., 1804)	*Fraxinus* sp.
Insecta, Diptera		
60	*Monarthropalpus flavus* (Schrank, 1776)	*Buxus sempervirens*
Mollusca, Gastropoda		
61	*Deroceras agreste* (L., 1758)	*Impatiens* sp., *Salvia* sp., *Hyacinthus* sp., *Begonia* sp., *Ageratum* sp.

A – alien species to Europe (a species introduced outside its natural distribution)

I – invasive species (an alien species which threatens ecosystems, habitats and species)

The results obtained and presented in this thesis are in line with the current concerns and progress in the field in European and US countries. The key conclusions pursuant to our research are outlined as follows:

1. The pests of dendroflora have been monitored in six locations in Bucharest, in the period 2008-2017.
2. Following the monitoring process within the six locations, 61 species of pests have been identified, belonging to 3 classes: *Arahnida*, *Insecta* and *Gastropoda*.
3. The pests with a strong impact on the landscape were: the box tree moth – *Cydalima perspectalis* Walker, 1859; the euonymus scale – *Unaspis euonymi* Comstock, 1881; the jasmine moth – *Palpita vitrealis* Rossi, 1794; the linde spidermite – *Eotetranychus tiliarium* Hermann, 1804, the ash sawfly – *Tomostethus nigritus* F., 1804; the sycamore lace bug – *Corythucha ciliata* Say, 1832; the horse-chestnut leaf miner – *Cameraria ohridella* Deschka et Dimić, 1986; the fall webworm moth – *Hyphantria cunea* Drury, 1773; the citrus flatid planthopper – *Metcalfa pruinosa* Say, 1830 and the brown marmorated stink bug – *Halyomorpha halys* Stal, 1855.
4. Most species of pests with high impact on the landscape process are ”alien species to Europe” (*Cydalima perspectalis* Walker, 1859; *Unaspis euonymi* Comstock, 1881; *Corythucha ciliata* Say, 1832; *Metcalfa pruinosa* Say; *Halyomorpha halys* Stal, 1855) or/and invasive species, for parks and ornamental gardens.
5. Once having penetrated and spread through new territories, without the presence of natural predators and parasites, these species of pests become invasive and extremely damaging to the new habitat, with an aesthetic, as well as social and economic impact on the landscape.

6. The *Tomostethus nigritus* F. wasp, though it is not a species that has entered our country within the timeframe 2010-2017, it has caused severe damage to the *Fraxinus* plants, in the Cişmigiu Park. The behaviour pattern of this species hasn`t been documented by the technical literature written in Romania.
7. The species of pests that have been detected, the type of damage incurred and the actual impact of the damage on the dendroflora are also detailed with suggestive photographs that could be used, as practice, for the process of determination of pest species.
8. The research regarding pest control in the case of certain species with high impact on parks and ornamental gardens bring out the possibilities and the difficulties encountered when need to control the pests in the specific urban green areas.
9. The obstacles encountered in the pest control process depend on a series of factors: the location of the plants (public or private area, close to playgrounds, to locations designed for rest and relaxation), the lack of plants that share low toxicity and of biologic products, the lack of means for implementation regarding such products (devices for tree injection), the lack of pheromone traps aimed at monitoring and control practices, the lack of involvement of which the administrative staff of the respective parks and ornamental gardens should be made responsible, regarding those actions aiming at the monitoring and control of disease and pests threatening the landscaping process.
10. The possibilities of pest control are limited in public green areas (the preservation of useful wildlife, the enhancement of plant strength, watering of the plants, usage of indicators plants, usage of pollinators enhancing plants (plants rich in pollen and nectar), pruning and clipping of plants, physical removal of caterpillar nests, dried branches or the total removal of affected plants). The dendro-floral nurseries or plant importing companies, trade companies or companies which produce specific dentro-floral products, private landscape gardens have multiple control means in order to reduce the pests pressure: physical methods, preventive methods, chemical methods - treatments based on chemical products may be tailor-made to the type of pest, or applied at the right moment, the planting of healthy specimens, uninfested by pests, ensuring the proper maintenance of plants, especially that of plants with a high aesthetic and economic value.
11. Experimental trials aimed at pest control, through phyto-technical measures, combined with chemical protection have outlined a good efficiency and can consequently be put into practice in nurseries and private ornamental gardens.
12. Some species of pests can create discomfort by penetrating households (*Halyomorpha halys*), laying on clothes (species of aphids), the colonization of walls, in order to find places conducing to pupae development (*Hyphantria cunea*), covering herbs with slurry-

based plants (aphids on linden trees). Also, *Corythucha ciliata* was reported in the summer of 2017 as an insect causing discomfort by pricking and producing allergies in humans. The literature does not indicate this species as haematopoietic.

13. The private and public urban green areas influence the quality of life. The health of the ornamental plants must represent a major concern for plant protection specialist and the entire population.