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HISTO-ANATOMICAL AND PHYSIOLOGICAL ASPECTS AT SOME PLANTS INDUCED BY BIOTIC FACTORS

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Abstract

Plants from USAMV Bucharest and from the areas surrounding the campus were studied. Finding and identifying the pests that attacked these plants were made inside the Genetics, Improvement and Plants' Protection Department, Entomology Section and the study of the morphological, histological and physiological changes that followed the attack of several pests were realised inside the Botanics and Plants' Physiology Department. The material was photographed with a digital camera. We mention that there are few data in the speciality literature regarding the morphological, histological and physiological modifications caused by the presented pests.

It was observed that changes concerning the aspect, anatomy and physiology of the diseased plants appear.

INTRODUCTION

Knowing the pests of the plants and the mutations caused by these is very important in order to limit the damage they cause. In all the developed countries it exists the preoccupation to create a microclimate favorable to human health, to embellish the exterior spaces and the constructed areas, to diminish the atmospheric pollution. That's why the parks, green areas, plantations of the traffic areas, decorative gardens represent an accomplishment of the modern development of the urban areas. Both the cultures of wooden species and the ornamental ones constitute the base skeleton of the green areas. The attack of several pests cause different mutations in what concerns the chemistry, morphology and physiology of the plants [1, 2]. From the speciality literature it is known that the pests can influence the reflectancy, depending on the attack degree of the leaf [7]. The diminution of the foliary surface leads to the reduction of the length and of the diameter of the wooden plants' stems, the reduction of the assimilation surfaces, the decrease of the wooden substance accumulation. It was observed that the intensity of the respiration in case of the atacked plants has higher values compared to the healthy plants, because ultrastructural modifications take place as a result of the deterioration of cellular walls and of the loss of partitions inside the cells. Also the carotin pigments are prevalent over the chlorophyll, therefore it takes place the

senescence of the leaves before reaching maturity and later death [6]. Under the influence of the pests takes place the deterioration or the distruction of the plants' existing structures and also the perturbation of the plant's normal development. In the case of the ornamental wooden species it must be taken into account that creating a green area implies many waiting years in which the cultures need to be taken care of, substantial expenses and that their distruction by not offering the proper attention to these plants can be very fast. In this paper we will present several examples of plants attacked by various pests and the modifications caused by these.

MATERIAL AND METHODS

The observations were made in the green areas from USAMV Bucharest and in the surrounding areas, in the period 2007-2008. Transverse sections were made in the studied leaves inside the Botanics and Plants' Physiology Department, Botanics Section. The sections were cleared with chloral-hidrate for 24 hours [8]. The microscopical compounds were fixed with jellified glycerine and the observations and the photographs were realized with the optical microscope type MC-7, having attached a Sony digital camera. Observations were made regarding the anatomical structures of the healthy and diseased tissues, in order to emphasize the modifications caused by the respective pests. At some plants photosynthesis and perspiration determinations were also made, both for healthy plants and for those attacked by aphids and mites. These determinations were made using the portable gas analyser LCA - 4. The analysis were made between the hours 8-11, at a temperature between 25-33.5^{0}C. In order to survey the pests, observations were made and samples were taken for determination of the pests. The activity of tracing and identifying the pests was done inside the genetics, Improvement and Plants' Protection Department, Entomology Section. The collected material was photographed directly on the field or in the laboratory using a Sony digital camera.

RESULTS AND DISCUSSION

Plants like: *Fraxinus excelsior* L., *Juglans regia* L., *Catalpa bignonioides* Walter [5]. were studied. At *Fraxinus excelsior* L. attacked by *Meliarhizofagus fraxinifolii* Ryley, synonymous with *Prociphylus fraxinifolii* Ryley, it was observed that the leaves have leaflets severely twisted (figure 1) and rippled in the first stage of the aphids' attack, and later they turn yellow and present necrosis. From the histological point of view it can be observed that the attacked leaves have the secretory hairs distroyed or atrophied and a disorganised mesophyll with necrosis (figure 2). In the case of a healthy ashtree leaf, the entire transverse section measured 17,25 µm and in the case of an attacked leaf of *Meliarhizofagus fraxinifolii* Ryley the section was of 24.75 µm. The measurements were made with the objective of 40X. It was observed that the respiration intensity in case of the

attacked plants has higher values compared to the healthy plants, because ultrastructural modifications take place as a result of the deterioration of cellular walls and implicitly of the loss of partitions inside the cells. At Fraxinus excelsior L. attacked by *Meliarhizofagus fraxinifolii*, the photosynthesis recorded negative values of -3.968 mycromoles $CO_2/m^2/s$ and the transpiration was 0.145 millimoles $H_2O/m^2/s$. The high value of the perspiration is caused by the vital activity of the aphids. At the healthy ashtree the photosynthesis was 1.635 mycromoles $CO_2/m^2/s$ and the perspiration was 0.093 millimoles $H_2O/m^2/s$.

At the plants of *Catalpa bignonioides* Walter a species of the *Aphis* family was found, that collonized both the leaves and the inflorescences (figure 3), reducing the ornamental value. When the attack takes place on the inflorescence in an early stage, the floral buds suffer an abortion [3, 4]. In figure 4 it can be observed the transverse section in the catalpa leaf attacked by aphids, the mesophyll and the epidermis of the leaf being severely necrosed. In the case of a healthy catalpa leaf, the entire transverse section measured 22.74 µm and in the case of a leaf attacked by aphis the section was of 24.25 µm. At the healthy *Catalpa bignonioides* Walter, at temperatures between 25- 26^0C, the photosynthesis was 1.44 mycromoles $CO_2/m^2/s$ and the perspiration was 0.04 millimoles $H_2O/m^2/s$. At the catalpa plant attacked by aphids the photosynthesis was 1.068 mycromoles $CO_2/m^2/s$ and the perspiration was 0.128 millimoles $H_2O/m^2/s$. At the walnut tree the eriophyid mite of the walnut tree was found - *Aceria erineus* (Nalepa). The attack manifests through the presence of felty formations of various sizes (figure5). The mesophyll is differentiated in palisade tissue with two layers and spongy tissue. After the mites attack these structures suffer mutations, the tector hairs get hypertrophied and elongated, the tissues from the mesophyll get necrosis, the tissues from the median vein get disorganized (figure 6), the leaves dry up. At the healthy walnut tree the photosynthesis was 1.207 mycromoles $CO_2/m^2/s$ and the perspiration was 0.098 millimoles $H_2O/m^2/s$. At *Juglans regia* L. attacked by mites the photosynthesis was -0.874 mycromoles $CO_2/m^2/s$ and the perspiration was 0.120 millimoles $H_2O/m^2/s$.

CONCLUSIONS

1. From the researches made it was observed that the aphids lead to the distruction of the cuticle and the necrosis of the epidermis, therefore this tissue stops performing its function, not allowing the regulation of perspiration and the gas exchange between the live tissues and the environment.

2. The assimillating tissues of the leaf (palisade and spongy tissue), because of the mutations produced under the attack of aphids and mites, stop performing their function of synthetysing organic substances through photosynthesis at normal capacity.
3. The aphids attack at catalpa plants led to the drying of the floral buds in the inflorescence or to the blooming of a small number of flowers, fact that determines an unaesthetic aspect of this ornamental plant.
4. For all the studied plants the values of photosynthesis are lower at diseased plants compared to healthy ones.
5. The perspiration had higher values at diseased plants compared to the healthy ones, for all analysed plants.

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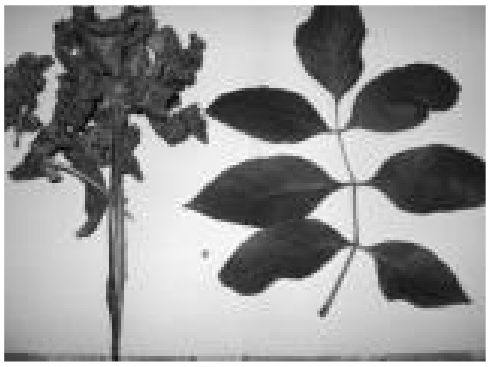

Fig. 1. Attacked ashtree leaf (left) and healthy leaf (right) (original)

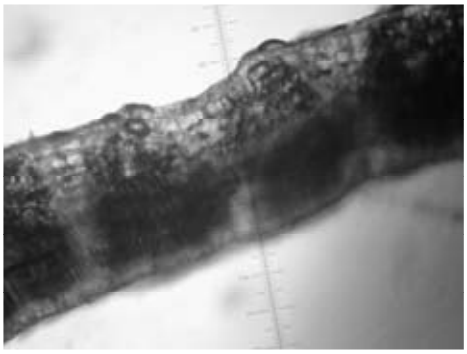

Fig. 2. Transverse section in the ashtree leaf attacked by aphids (original)

Fig. 3. Catalpa inflorescence attacked by species of the *Aphis* family (original)

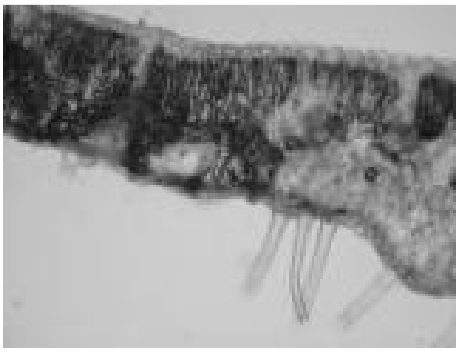

Fig. 4. Catalpa mesophyll and lower epidermis with necrosis caused by aphids (original)

Fig. 5. Attacked *Juglans regia* L. leaf by eriophyid mites (original)

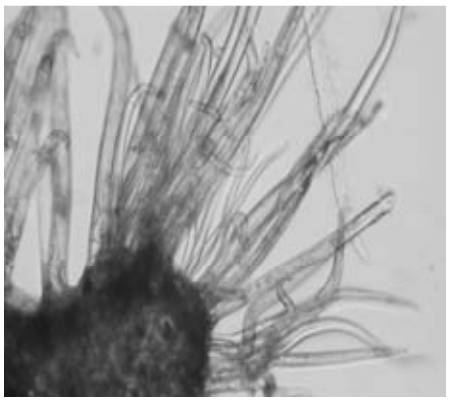

Fig. 6. Transverse section in the leaf of *Juglans regia* attacked by eriophyid mites (original)