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# PHYTOSANITARY STATE OF KAZAN CENTER GREEN PLANTATIONS

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**Abstract:**

*The impact of urban ecosystem factors leads to the weakening of introduced and wild-growing tree and shrub plants, which makes them more accessible to diseases and can eventually lead to the loss of decorativeness, fragility and even plant death. Phytopathological monitoring was carried out using routing research methods. They examined the urban plantings of 5 categories, which differ in the degree of anthropogenic change. During the research, they determined the type and the nature of specific species diseases, the pathogen causing it, and the intensity and the prevalence of a number of diseases. An ocular 5-point scale was used to take into account the intensity of diseases: 0 points - the absence of lesions; 1 point - up to 10% of the surface is damaged; 2 points - 11 - 25% is damaged; 3 points - 26 - 50% is damaged; 4 points - more than 50% of the surface is damaged. The prevalence of the disease was calculated in %, to the total number of inspected plants. The result of research showed that trees and shrubs were affected by three groups of diseases most often: spotting, rust and powdery mildew. The most affected species in the urban environment under study: Tilia córdata Mill., Malus domestica Borkh., Acer platanoides L.*

**Key words**: *plant diseases, green plantations, pathogens.*

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## INTRODUCTION:

Phytopathological research is an important part of green plantation state monitoring in a diverse urban environment. Urban plantations are unique ecosystems, relatively adapted to adverse human impacts. The elements of open and closed landscapes, natural and cultural plant communities, various physical-geographical and soil zones, altered by the conditions of the urban environment, are interwoven in various ways. Green plantations have species - introducents and the species of native flora. Such plantations are characterized by low ecological reliability; therefore, they need a constant care and support from the person. The surveyed areas are influenced by various negative environmental factors, such as an urbanized soil with poor aeration, a highly polluted air environment, unstable and altered humidity and temperature regimes, often combined with inappropriate measures of maintenance and the care of introduced and native species [1-8]. This leads to the weakening of plants, they become more accessible to pests and diseases, which ultimately leads to the loss of decorativeness, fragility, and often to the death of individual species. A large variety of pathogens is formed from different sources - nurseries, nearby forests, farmlands, the objects of new species, forms and varieties introduction, etc. [9].

The objects of phytopathological monitoring are the green plantations of various purpose and status. Plant diseases can cause great ecological and economic damage to both green plantations in general, as well as to human perception of a green zone in various parts of an urbanized environment. Particularly great damage is caused by mass plant damage from infectious diseases. In this regard, the collection and the analysis of phytopathological information and its use for the prediction of epiphytology and decision making on the appropriateness of various measures for the prevention and the suppression of disease development and the reduction or prevention of damage are relevant.

## MATERIALS AND METHODS OF STUDY:

The collection of phytopathological information was carried out during the growing seasons of 2015 and 2016 on the territory of Kazan using routing methods of research. Five types of urban plantings were surveyed, which differ by the degree of anthropogenic change: natural plantations - intra-urban recreational forests - and artificial plantations - parks, gardens, squares, intraquarter plantings and the plantings along the streets.

Phytopathological monitoring begins with the identification of problematic phytopathological situations in various urban landscapes. At this stage the plantations with impaired disease resistance were identified, the type and nature of the disease (infectious or non-infectious), the duration of a lesion were determined, the conditions that contributed to the development of diseases were identified.

The next obligatory stage was the diagnosis of woody plant and plantation diseases, the identification of the causative agent species of the most significant infectious diseases.

In addition to disease identification and a pathogen causing it, the intensity and the prevalence of diseases were assessed for specific tree and shrubby species in various urban plantations. The visual scale was used to take into account the intensity of diseases where 0 points correspond to the absence of lesions; 1 point - up to 10% of a surface is damaged; 2 points - 11 - 25% is damaged; 3 points - 26 - 50% is damaged; 4 points - more than 50% of the surface is damaged. The intensity of plant damage serves as a qualitative indicator characterizing a disease. The prevalence of a disease is represented by the number of diseased plants, expressed as a percentage of the total number of patients examined [10]. This value was calculated by the following formula:

P = n / N 100, where

P - the prevalence of a disease, %

N - number of diseased plants, pcs.

N - total number of inspected plants, pcs.

## STUDY RESULTS:

Among the found diseases of plants, the infectious diseases caused by fungi predominate. The share of non communicable diseases is much lower (13% vs. 87%). Noninfectious diseases of plants are represented by two groups: mechanical damage of cortex and marginal necrosis of leaves. Mechanical damages of the bark are present in all categories of green plantations. Their smallest number is met in the types of intra-urban recreational forests. This is due to the fact that the cleaning of urban areas is carried out, mainly, by mechanical means with the use of small equipment, serviced by low-skilled labor. Only the main, paved paths and hiking trails, where most of the affected species grow, are cleaned in the intra-urban recreational forests during winter time. Cracks have different sizes and shapes, often secondary infection is developed on them, for example, *Schizophyllum commune* (Fries). The wrong pruning also occurs, leading to the nectria damage of the shoots (*Nectria cinnabarina* Fr.), that can lead to a tree death in the future. This type of infection was

found on *Crataegus oxyacantha L., Acer platanoides L., Ulmus laevis Pall., Ulmus glabra Huds*., etc.

Marginal necrosis of leaves is characteristic mainly for *Acer platanoides L., Tilia cordata Mill., Tilia europaea L.* Most often they occur in plants growing along the streets that may be explained by an improper cultivation technique of plant growing, the drying up of soil and the withering of young tree root system, the lack of nutrients in a soil and high recreational loads.

Identified infectious diseases can be divided conditionally into three groups: spots, rust and powdery mildew.

Spots appeared on the plants of different ages, but they represent the greatest danger for young plants. Among the group of spots, the most common were: alternaria on *Malus domestica Borkh*., *Sorbus aucuparia L.* (Alternaria alternate (Fr.) Keissl); ascochytosis on *Sorbus aucuparia L.* (*Ascochyta viburni Roum Ex Sacc*.) and *Crataegus oxyacantha L.* (*Ascochyta crataegi Fckl*.); Septoriosis on *Malus domestica Borkh* (*Septoria crataegicola* (Bond) *Tranzsch* and *Populis pyramidalis Salisb* and *Populus balsamifera L.* (*Septoria populi Desm*), *Quercus robur L.* (*Septoria quercina Desm*); Phyllosticta leaf blight on *Sorylu savellana* (*L.*) *H.Karst* (*Phyllosticta corylaria Sacc)* and *Rosa rugosa Thunb*. (*Phyllosticta rosae Desm*); brown spot birch (*Marssonina betulae (Lib.) Magnus*); brown spot elm (*Cylindrosporium ulmi Vassil*); blackspot maple (*Rhytisma acerinum* (Pers.) Fr., blackspot birch (*Dothidella betulina* (Fr.) Sacc.), scab on *Malus domestica Borkh*. (*Venturia inaequalis* (Cooke) Wint.).

Spotted areas are widely distributed in intra-quarter plantings and small squares. Their smallest number was found on the species growing along the streets.

Most diseases of rust type are characterized by the presence of an intermediate host, which may be represented by herbaceous and woody plants. This group of diseases refers to very harmful diseases. Barberry may be one of the intermediate hosts for the rust of cereals. The disorders of barberry during summer stages of fungus *Puccinia graminis* Pers. development are very common. This shrub is often used for gardening in the form of hedges, especially in parks, squares and along streets. The intensity and the prevalence of lesions in these zones is approximately the same one.

The most common rust is on such species as *Pinus sylvestris L. (Melampsora pinitorqua L.), Populus tremula L. (Melampsora tremulae Tul.), Populis pyramidal Salisb. And Populus balsamifera L. (Melampsora populina (Pers.) Lev., On Rosa rugosa Thunb. (Phragmidium fusiforme J. Schröt., On Sorbus aucuparia L. (Crymnosporangium juniper Link.).*

More often the disease was observed on the species *Populus tremula L., Populus pyramidalis Salisb*. and *Populus balsamifera L.*, which grow along roads, in small squares and intra-quarter plantings. Trees of young age were more damaged. In order to prevent the development of the disease, it is necessary to carry out preventive and therapeutic measures related to the removal of the pathogen intermediate hosts.

One of the most common groups of diseases is powdery mildew. It affects many species of woody, shrubby and herbaceous plants, but parasitic fungi are specific to a host plant, although the symptoms of the disease are very similar. Strong lesions were observed among *Acer platanoides* L. (*Uncinula aceris* Sacc.), *Populus balsamifera* L. (*Erysiphe adunca* (Wallr.) Fr., *Ulmus laevis* Pall. (*Phyllactinia guttata* Wallr.), *Quercus robur* L. (*Erysiphe quercina* Schwein.), *Betula pendula* Roth. (*Erysiphe ornate* U. Braun & S. Takam.), *Malus domestica* Borkh. (*Erysiphe mali* Duby.), *Syringa vulgaris* L., *Syringa josikaea* J. Jacq. ex Rchb. (*Erysiphe syringae* Schwein.), *Rosa rugosa* Thunb. (*Erysiphe pannosa* (Wallr.) Link.), *Tilia cordata* Mill., *Tilia europaea* L., *Crataegus oxyacantha* L., *Sorbus aucuparia* L., *Cornus stolonifera* Michx. (*Podosphaera oxyacanthae* de Bary.).

Powdery mildew was found in inter-quarter plantings, gardens and squares most often, especially in the areas with thickened plantings or little care for green plantations.

The prevalence of diseases in the composition of the investigated populations of woody and shrubby species makes 7-98% (Table 1). The highest prevalence of diseases is typical for *Tilia cortata* in the plantings along streets and intra-quarter plantings, *Malus domestica* in parks, squares and intra-quarter plantings, *Betula pendula* as the part of intra-quarter plantings.

**Table 1: The degree of trees and shrubs damage by various diseases in the center of Kazan**

| Species | Disease | Intensity, score | Prevalence, % |
|---|---|---|---|
| Park, square, garden plantings | | | |
| *Tilia cordata* Mill. | Edge necrosis | 2 | 12 |
| *Betula pendula* Roth. | Powdery mildew | 1-2 | 10 |
| | Rust | 1-2 | 18 |
| *Quercus robur* L. | Powdery mildew | 1-2 | 47 |
| | Mechanical bark damage | 2 | 8 |
| *Acer platanoides* L. | Powdery mildew | 1-3 | 34 |
| | Black spotting | 2-3 | 28 |
| *Acer negundo* L. | Brown spotting | 1 | 12 |
| *Populus balsamifera* L. | Rust | 1 | 27 |
| *Crataegus oxyacantha* L. | Powdery mildew | 1 | 37 |
| *Malus domestica* Borkh. | Scab | 3 | 98 |
| | Moniliasis | 3 | 97 |
| *Pinus sylvestris* L. | Dry tops | 1 | 12 |
| Intraquarter plantings | | | |
| *Tilia cordata* Mill. | Mechanical bark damage | 1 | 71 |
| *Betula pendula* Roth. | Powdery mildew | 2-3 | 9 |
| | Mechanical bark damage | 1 | 79 |
| *Acer negundo* L. | Mechanical bark damage | 1 | 27 |
| | Brown spotting | 2 | 35 |
| *Acer platanoides* L. | Powdery mildew | 2 | 37 |
| *Populus balsamifera* L. | Rust | 1 | 12 |
| *Malus domestica* Borkh. | Mechanical bark damage | 1 | 84 |
| | Scab | 2 | 77 |
| | Moniliasis | 2 | 77 |
| *Prunus padus* L. | Pockets | 2 | 89 |
| Plants along the streets | | | |
| *Tilia cordata* Mill. | Edge necrosis | 4 | 84 |
| | Mechanical bark damage | 2 | 88 |
| *Populus balsamifera* L. | Rust | 1 | 12 |
| *Picea pungens* Engelm. | Withering of needles | 2 | **7** |
| Urban recreational forests | | | |
| *Tilia cordata* Mill. | Edge necrosis | 1-2 | 5 |
| *Betula pendula* Roth. | Powdery mildew | 1-2 | 4 |
| | Rust | 1-2 | 8 |
| *Quercus robur* L. | Powdery mildew | 1-2 | 22 |
| | Mechanical bark damage | 2 | 16 |
| *Acer platanoides* L. | Powdery mildew | 1-3 | 22 |
| | Black spotting | 2-3 | 54 |
| *Acer negundo* L. | Brown spotting | 1 | 8 |
| *Populus balsamifera* L. | Rust | 1 | 9 |
| *Crataegus oxyacantha* L. | Powdery mildew | 1 | 7 |
| *Malus domestica* Borkh. | Scab | 3 | 27 |
| | Moniliasis | 3 | 26 |
| *Pinus sylvestris* L. | Dry tops | 1 | 3 |

The intensity of disease among *Tilia cortata* is within 1-4 points. At the same time, the intensity of lesions increases in a row from intra-quarter plantings to the plantations along the streets, where this index among limes has the greatest significance among all the species under study. Relatively low values of lesion (1-2 points) were found in the leaves of *Acer negundo, Populus balsamifera, Crataegus oxyacantha*, and also in the needles of *Picea pungens* and *Pinus sylvestris*. The low degree of infestation by

the phytopathogens of introducent species (*Acer negundo, Populus balsamifera, Crataegus oxyacantha, Picea pungens*) indicates their relative stability in comparison with native species.

## CONCLUSIONS:

The studies revealed that trees and shrubs were affected by three groups of diseases most often: spotting, rust and powdery mildew. The most affected species in the urban environment under study are: *Tilia córdata Mill., Malus domestica Borkh., Acer platanoides L.*

## SUMMARY:

The obtained results show that urban environment conditions influence the intensity and the prevalence of diseases, so the lowest values of these indicators are characteristic for intra-urban recreational forests. The biodiversity of diseases, obviously, depends on the biotic and abiotic factors of the environment and on the intensity of anthropogenic impact.

The obtained data can be used during the planning of protective measures and the forecasting of a phytosanitary situation in the green zones of the urban environment.

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## REFERENCES:

1.Nowak D.J. Air pollution removal by urban trees and shrubs in the United States / D.J. Nowak, D.E. Crane, J C. Stevens // Urban Forestry & Urban Greening. 2006. V.4. pp. 115-123.

2.Rucandio M.I. Biomonitoring of chemical elements in an urban environment using arboreal and bush plant species / M.I. Rucandio, M.D. Petit-Domínguez, C. Fidalgo-Hijano, R. García-Giménez // Environmental science and pollution research. 2010. Vol. 18, № 1. pp. 51-63.

3.Climate and the environment of the Volga Federal District / Scientific Ed. M. L. Vereshchagin. - Kazan: Publishing house of the Kazan University, 2013. 274 p.

4.Climate of Kazan and its changes during the modern period / Yu.P. Perevedentsev, E.P. Naumov, K.M. Shantalinsky and others - Kazan: Kazan state University, 2006. 216 p.

5.Stroganova M.N., Agarkova M.G. Urban soils: the experience of study and systematics (on the example of soils in the southwestern part of Moscow) // Soil study. V. 7. 1992. pp. 16-24.

6.Turer D.G. Heavy metal contamination in soils of urban highways: comparison between runoff and soil concentrations at Cincinnati, Ohio / D.G. Turer, J.B. Maynard, J.J. Sansalone // Water, Air and Soil Pollution. 2001. V. 132. pp. 293-314.

7.Wang X.S., Qin Y. Spatial distribution of metals in urban topsoils of Xuzhou (China): controlling factors and environmental implications. Springer-Verlag. 2005. pp. 905-914.

8.Stepanova N.Yu. Integral assessment of atmospheric air quality in Kazan according to chemical and biological monitoring data / N.Yu. Stepanova, L.V. Novikova, D.V. Grashina, G.V. Demina // Safety in the technosphere, No. 6, 2013. pp. 20-23.

9.Sokolova E.S. State of wood and shrubby species in hedges and their damage by diseases // Ecology, monitoring and rational nature management: scientific work. Moscow: MGUL, 1998. - Issue. 294 (1). pp. 41-46.

10.Safin R.I. Phytosanitary monitoring / Textbook. - Kazan: Publishing house of KGSHA, 2004. 100 p.