The influence of urbanization on the phytosanitary status of elm plantations of Volgograd agglomeration

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Abstract. The studies of the phytosanitary condition of elm trees in plantations of different functional purposes have been carried out. It was established that in the urban agglomeration on elm trees stem and butt rots, necrosis of branches, mycoses and bacteriosis predominate. Factors causing the development of infectious diseases \textit{Ulmus L.}, which can be attributed to a high anthropogenic load on the soil, mechanical damage to the trunks, violation of the technique of pruning the crown were identified.

1 Introduction

The development of greening systems in urban areas now is inextricably connected with urbanization [1-4]. Green plantations of general use and special purpose in agglomerations are subject to a complex of limiting factors that adversely affect the growth and development of woody plants [3-12]. Among the most significant causes can be identified pollution of the environment, soil degradation, high recreational load [13-16]. The conditions of growth are worsened by the arid climate, insufficient care for plantings and a decrease in areas [17-27]. Numerous reasons weaken the woody plants and reduce their resistance [28-31].

In this context, green plantations in cities become hotbeds for the development of infectious diseases [2, 3, 13-15]. However, due to lack of the specialized organizations in municipalities phytopathological monitoring of these plantations is not carried out [27-31]. The reliable information about the state of planting lands is absent, which makes it difficult to develop a system for the protection of woody plants, planning and carrying out measures to combat diseases and pests of ornamental crops [1, 2, 15, 16]. In this regard, the issue of a detailed study of the influence of urbanization on the phytosanitary state of plantations is relevant. The results obtained in the study in this direction will solve a large number of different problems.

The obtained solutions can also be used for various regions of Russia, taking into account their specificity and climatic conditions.

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2 Methods

The objects of the study were greenery plantations with the participation of species of the generic *Ulmus* L. [15, 16] complex of public use (along the streets Respublikanskaya, N. Simonova, Krasnopolyanskaya, 8th Air Army, Memory Square), restricted use (Municipal School No.100, VDTS Medical Centre., Clinic No. 1 VolGMU) and special purpose (shooting club «Professional», Public Corporation Business Enterprise «Makarna», Limited Liability Company «Technoinvest»). Field studies of the state of woody plants were carried out in 2016-2017. In this case, more than two thousand elm trees were surveyed, mainly with an age of more than 30 years. The state of the plantations was evaluated. The measurement of plants during detailed inventory at sites was carried out according to the method of A.P. Anuchin [1, 16], the definition of the systematic affiliation of plants according to the determinant and reference books.

In the age category from 30 to 45 years, the elm trees had a height of 4.9-10.5 m and a trunk diameter of 15.6-42.3 cm. No direct connection between the height, diameter and sanitary state of the trees was found (Fig. 1).

![Fig. 1. Taxonomic indicators of elm trees in greenery plantations of different types](image1)

It is established that ordinary plantations in street greening in the common use area have got a very high percentage of trees in unsatisfactory condition (54.2-76.4%) (Fig. 2).

![Fig. 2. The influence of growing conditions in greenery plantations of different types](image2)
This pattern is also observed in the sanitary protection zones of industrial enterprises, where the protective belts are planted as several rows of elm, where the share of benign trees is only 14.7% (for example, Limited Liability Company Technoinvest).

In all categories of plantations, there is a digression, which reached the last and the penultimate stage IV-V. It is comparatively better for the state of plantations of medical centers (VDTS Medical Centre, Clinic No. 1 VolGMU) and public gardens (Memory Square) despite the high recreational load. Territories of special purpose, relating to industrial enterprises, experience a high degree of environmental pollution, which increases the process of degression. The same pattern is also observed in street plantations along highways, where emissions from motor vehicles are influencing. There is a close relationship between the proportion of trees in the unsatisfactory state and the index of the ecological intensity of the territory \((r^2 = 0.60)\), based on the amount of pollutants in the natural environment.

It was revealed that the tense environmental situation reduces the resistance of the elm trees to phytopathogenic organisms (Fig. 3).

![Fig. 3. Distribution of the main types of phytopathogens in the elm trees plantations in the Volgograd agglomeration](image)

**3 Results and Discussion**

The most noticeable damage to the elm plantations is caused by necrosis of branches, stem rot, and bacteriosis. These diseases develop in the form of hotbed and lead to the rapid drying of trees. Their spread is facilitated by open wounds as a result of mechanical damage to the bark on trunks, broken branches, non-observance of sanitary rules with rejuvenating pruning of crowns.

It should be noted that at the age of 30-45 years elm trees in urbanized areas are subjected to deep rejuvenating pruning (so-called crown reduction pruning). As a result of this action, all branches are cut out, and the crown is cut at a height of 5 m. On the trunks in the places of spills, large wounds with an area of 0.04-0.07 m² are formed, which are not treated with fungicides. They are places of infection in the trunk. This method leads to the spread of Dutch elm disease, stem rot and necrosis.
As a result, the overwhelming majority of trees in the plantation are infected. However, they do not appear immediately, but in 4-5 years after the deep pruning. The infection develops in the trunk and growing branches during this period. The visual effect among the crowned trees is observed after five years, when there is a sharp deterioration of the phytosanitary state as a result of mass dryness or complete drying of the reconstructed crowns. The diseased trees with the above listed diagnoses represent an emergency hazard are the centers of spread of the infection and are subject to disposal.

4 Conclusions

Thus, the urban environment has a negative impact on the elm trees. It is expressed in a decrease in the resistance of trees caused by pollution of the territory by industrial enterprises and vehicles. Negative influence provokes the development and spread of a complex of dangerous diseases of fungal and bacterial etiology, which leads to the emergence of hotbed of infection and mass death of trees. In this situation, it is necessary to develop a set of measures to reconstruct the elm trees plantations and improve their phytosanitary condition.

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