Diagnostics of the genus Acer L. diseases using the pathographic method on the territory of Sokolovogorsk Park in Saratov

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Abstract. The article analyzes the diseases and pests of the trees of the genus Acer L. It was found out that the most resistant species on the territory of the studied object is Acer negundo L. It was found out also that 80-95% of black spot (Rhytisma acerinum) affect the leaves of Acer platanoides L., and powdery mildew (Uncinula aceris Sacc) damages them either. The brown spot (Phyllosticta fraxinicola) affects 50-68% of Acer campestre. The most effective chemical preparations have been determined, i.e. Skor (85-97%). Iron vitriol for the table (at a concentration of 8-10%, 400 g per 100 water) effectively helped to cope both with lichens - lichens disappeared during 4-6 days, and with powdery mildew, various rot disappeared up to 70-89%. Effective biological preparations have been identified to combat spotness, such as Baktotif (positive result - 83%), Gamair (positive result - 80%), Fitosporin-M (positive result - 78%).

1. Introduction

One of the widespread plants in Saratov city is the genus Acer L. In Russia, about 78 species of maple grow, each hird species refers to one of the introduced species. The demand in planting in the cities depends on its decorative qualities, resistance to impacts of anthropogenic loads, as well as the ability to withstand most of the plant diseases with the possibility of further complete restoration of their vital activity. At the moment the extensive study of maples constitutes the results of habitat, dispersal and endurance of maple species under the influence of anthropogenic and natural loads. Presently the study of Acer L diseases is being carried out, infections caused by various pathogens are being tested in the following cities Ryazan, Moscow, Arkhangelsk, Moscow.

Despite the widespread growth of Acer platanoides L. on the territory of Right bank of Saratov region, some aspects still remain to be unexplored. The research activities are being carried out in the field of studying plant root system and its biometric characteristics. The distinctive features of this species include a wide range of breeding methods: i.e. grafting, shoots, seeds, cuttings. Due to its decorative effect these species are widely used in landscape plantings during the growing season. It tolerates a branch cut, therefore it is used as a bonsai, hedges, etc. With the general unpretentiousness of the plant, the species is picky about the soil and does not withstand acidity and waterlogging. With mass planting of Norway maple, the spread of diseases and pests of this type increases.

Acer negundo L. is highly tolerant to the deficiency of soil moisture, as well as the lack of nutrients in soils, effective in difficult landscapes such as: roadssides, wastelands, railroad slopes, pine forests
and typographers spruce forests under the influence of anthropogenic factors [2]. Thanks to fast-growing qualities, this species reaches the generative stage of development in the 5th year of the stage development, which allows to establish the floor of the planting [1-2] at an early age. Depending on its gender, the plant has different requirements in relation to environment, females, unlike males, grow better in moist places with rich nutrients in soils. Male individuals tolerate dry weather conditions and soil salinity well, which manifests itself in a denser crown form. In many works it is noted that when following correct planting and care techniques, Acer negundo L. lives up to 70 years in urban conditions, with a maximum age of 100 years. It is also related to using sparse plantings, as a result of which the tree bifurcates and forms a powerful trunk, in dense plantings the trunk is curved, which reduces life span by half [3-5].

Most scientists claim that Acer negundo L. does not form root shoots for the rest of their lives, which qualitatively facilitates post-plant care. Root and stump growth appear when the plant is removed under the root, and also when it is cut down. In this case, at the base of the mother trunk, dormant buds, promoting the development of shoots and daughter multi-stem trees [5].

Acer negundo L. have a relatively slow growth, similarly to other types of maples propagated by cuttings, grafting, and seeding. The root suckers from damaged roots are picky about soils and are more thermophilic than Norway maple. It tolerates transplanting, drought and branch cut, which allows to use its hybrid varieties as hedges. The age of the plant can reach 100-200 years, therefore it is of great demand in urban conditions, as well as when creating forest reclamation belts.

The genus Acer L. is often damaged by lichens. Over the past decades a correlation dependence between lichens and ecological state of the environment have been discovered in the works of researchers [1; 4-8]. In this case lichens act as biological indicators of air pollution: the fewer lichens species are found on the territory, the more polluted the atmospheric air is, which means that the area covered by lichens will be reduced [7].

Despite numerous scientific works in Saratov, the state of the genus Acer L. has been studied only for the last 10 years, incl. in Sokolovogorsk park.

Hence, diagnostics of diseases of the genus Acer L. is relevant at the present time. The purpose of this study is to identify common diseases plantations of the genus Acer L. within the garden and park territory of the studied object. Research objectives are to diagnose the state of woody plantings using the pathographic method, to identify the main pathogens of tree diseases, factors contributing to their appearance, make up recommendations for preventing the development of diseases and pests.

Scientific novelty is the identification of diseases and injuries of the genus Acer L. in Sokolovogorsk park in Saratov for the treatment and improvement of the state of the green plantings in it.

2. Materials and methods

The studies were carried out on the territory of the Sokolovogorsk park in Saratov with a total area of 80 hectares. The object of the study were the species of the genus Acer L.: Acer platanoides L., L., Acer negundo L. The territory of the park was divided into the plots of 20 hectares each. With the help of the pathographic method, diseases were identified in such plants as: Norway maple (Acer platanoides L.), field maple (L.), ash-leaved maple (Acer negundo L.). The essence of the method was visual inspection of plants in the field, in which careful examination of trees for neoplasms (wounds, tumors): on the branches, trunks, roots; drying out of branches; states of the leaf plate: color and spots.

When analyzing plantings by this method, much attention was paid to the conditions of plant growth. Due to the prolonged droughts or frosts in deciduous trees cytosporous (fungi of the genus Cytospora) and tubercular (fungi of the genus Cytospora), necrotic lesions [3] can be developed.

When inspecting the plantings, special attention is paid to the drying of the crown. Depending on the localization of drying, the type of disease can be determined. When drying is found in the upper part of the crown, we are talking about possible vascular diseases of wood, unfavorable soil conditions or root rot. When branches dry in the middle part vascular and necro-cancerous diseases should be taken into account. They include: Verticillium desiccation (wilt) (fungus Verticillium dahliae) -
vascular disease in which dark spots form dark brown diffuse rings on the trunk or branches. This type of disease most often affects Acer platanoides L.

The type of plant placement allows us to determine the ongoing processes of plant diseases. If trees grow in clumps, in groups, the process has infectious nature with complete or partial drying of the branches of the crown.

The use of the pathographic method allowed us to identify characteristic signs of plant diseases at different stages of vegetative development of trees and shrubs.

An inventory of plants was made, as a result of which it became possible to identify general patterns of diseases, depending on the type of plantings and their life states. The photographs of the types of diseases have been made. Material handling was performed on a personal computer with a spreadsheet processor Microsoft Excel 3.

3. Main part. Research results

During the research, we have considered 140 pieces. green spaces, characterized by common signs of growth: climatic conditions, nature relief, as well as the type of plantings. We have studied the flora found in group plantings, as well as in the form of tapeworms, the species of single green plantations not susceptible to infectious diseases. To such plants field maple (L.) and Norway maple (Acer platanoides L.) can be attributed. The greatest degree of infection caused by infectious diseases was found in Acer negundo L., which is a group of curtain planting. We determined that 25% of maple species were affected by Lichenes and identified two types of lichens that were formed on the bark of trees together: lichen Fiscia powdered (Phaeophyscia orbicularis Moberg) and Xanthroia wall (Xanthoria pariet) with apothecia (figure 1). This species is classified as foliose lichens, typical for the steppe zone with a lack of moisture.

![Figure 1. Phaeophyscia orbicularis lichens Moberg and Xanthoria parietina L. (with apothecia) on the bark of Acer platanoides L.](image)

Lichen Fiscia powdered (Phaeophyscia orbicularis Moberg) is one of the most resistant species to environmental pollution. Xanthroia wall (Xanthoria parietina L.) or Zolotyanka, like the first species, tolerates high air pollution and does not harm trees.

We have compiled the ratios of diseases and the Acer species (figures 2-4). On the diagrams it can be seen that the most susceptible to diseases was Acer platanoides L. Acer platanoides L. is the only species affected by vascular disease.
On figure 2 it can be seen that 28% of 50 pcs. Acer platanoides L. were not affected by fungal, bacterial diseases, as well as non-infectious diseases i.e. marginal necrosis. Marginal necrosis was detected in 12% of trees, which contributes to a number of factors, such as: lack of nutrients in the soil (in some areas) and gas pollution - in others.

Figure 3 shows Acer negundo L diseases, which account for 35% of the total number analyzed (40 pieces). They turned out to be immune to diseases (65% of the plantings), this figure is 2.3 times more than that of Acer platanoides L. and practically corresponds to the indicator (64%) of Acer Campestre L. It can be assumed that the diseases are infectious and are not associated with unfavorable climatic conditions. The causative agents of such a disease, like powdery mildew, are the mushrooms Erysiphe (Uncinula bicornis) and Erysiphe tulasnei (Uncinula. Tulasnei), which lead to premature drying of plant leaves and their falling, reducing resistance to adverse conditions of external environment. The spread of this nature is facilitated by the growth of ash-leaved maple in clumps and group plantings, which is not regulated by thinning and is spontaneous. Thus, the disease is transmitted by spores, through air. Due to the high temperatures in the growing season period 2020 (table 1), there is a favorable factor for permanent development of this type of disease, which begins to develop at an air temperature of 17 to + 25 °C.
Figure 4 shows that in Acer campestre L., the main disease of Acer campestre L., is marginal necrosis and leaf lichen. Accordingly, such problems could appear because of the weakness of plantations manifested due to parasitic fungi and freezing of the bark.

The period of blooming of leaves in the genus Acer L. begins in April, depending on the species it can last for one month. Coloring and leaf litter starts from October. The early leaf fall can be caused not by infectious diseases in plants but by unfavorable environmental conditions. These include drought, soil compaction and/or pollution, waterlogging. We have made monitoring of the temperature regime for vegetative period April-October 2020 (table 1).

### Table 1. Air temperature during the growing season.

| Year | April | May | June | July | August | September | October |
|------|-------|-----|------|------|--------|-----------|---------|
| Tmin (°C) | Tmax (°C) | Tmin (°C) | Tmax (°C) | Tmin (°C) | Tmax (°C) | Tmin (°C) | Tmax (°C) |
| 2017 | -4    | +2  | +5   | +12  | +13    | +2        | -3       |
| 2018 | +24   | +26 | +29  | +36  | +35    | +30       | +19      |
|      | -1    | +5  | +2   | +15  | +10    | +5        | -6       |
| 2019 | +21   | +33 | +35  | +37  | +32    | +32       | +21      |
|      | -3    | +2  | +10  | +10  | +5     | +1        | -4       |
| 2020 | +25   | +31 | +36  | +31  | +34    | +27       | +20      |
|      | -4    | +4  | +8   | +11  | +9     | +3        | -5       |
|      | +23   | +28 | +33  | +39  | +33    | +32       | +22      |

Note: Tmin - Minimum temperature - minimum air temperature at a height of 2 m above ground; Tmax - Maximum temperature - maximum air temperature at a height of 2 m above the ground [8].

Table 1 shows that the hottest month is July, with maximum temperatures varied within +31 - +39 °C. For development of marginal necrosis in trees, a high air temperature should be +25 ... +30 °C despite sufficient relative humidity. Thus, for six months a year the average temperature is 30 °C, which adversely affects the life of Acer platanoides L. and Acer campestre L. At the same time, Acer platanoides L. is not affected by high temperatures and shows good results.

It is known that high temperature contributes to the development of fungal diseases.
From the figure 5 it is seen that black spotting (Rhytisma acerinum) strike the leaves of Acer platanoides L. to 80-95%, and powdery mildew (Uncinula aceris Sacc) and brown spotting (Phyllosticta fraxinicola) affect Acer campestre to 50-68% LL 6.

In total, our study of the condition of the leaf plate of trees revealed the main groups of diseases and pests:

- Vascular diseases - verticillious drying or verticillosis (fungus Verticillium dahliae);
- Fungal diseases - Black spotting (fungus Rhytisma acerinum), Powdery mildew (fungus Uncinula aceris Sacc), Brown spotting (fungus Phyllosticta fraxinicola) (figure 5-6);
- Non-communicable diseases - lat. marginal folium necrosis (marginal leaf necrosis); 4) loaners - Acronicta aceris.

4. Conclusion

Thus, our studies of the state of woody vegetation on the territory of Victory Park in the city of Saratov showed:

- It was found that the detected flora diseases are the result of a number of adverse environmental factors: dry growing periods without precipitation are the main ones;
- It was determined that the main indicators of infectious diseases were the types of plantings of green spaces and the nature of damage of leaf plate;
- The indicators of adverse changes were revealed: dry air, crowded planting due to self-settling, lichens, their types and distribution area;
- It was found out that black spotting (Rhytisma acerinum) affected 80-95% of leaves of Acer platanoides L., and powdery mildew (Uncinula aceris Sacc) and brown spotting (Phyllosticta fraxinicola) affected 50-68% of Acer campestre;
- The following drugs for identified diseases and pests are recommended: the most effective of the chemical drugs is Scor (85-97%). The iron cupola (at a concentration of 8-10%, 400 g per 100 water) effectively helped to cope with both lichens - lichens fell away in 4-6 days, as well as powdery mildew and various rots (70-89%). In spring, copper cuprose is used to treat branches in this way. With a weak manifestation of spotting: Baktofit was sprayed with biological preparations (positive result - 83%), Gamair (positive result - 80%), Phytosporin-M (positive result - 78%).
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