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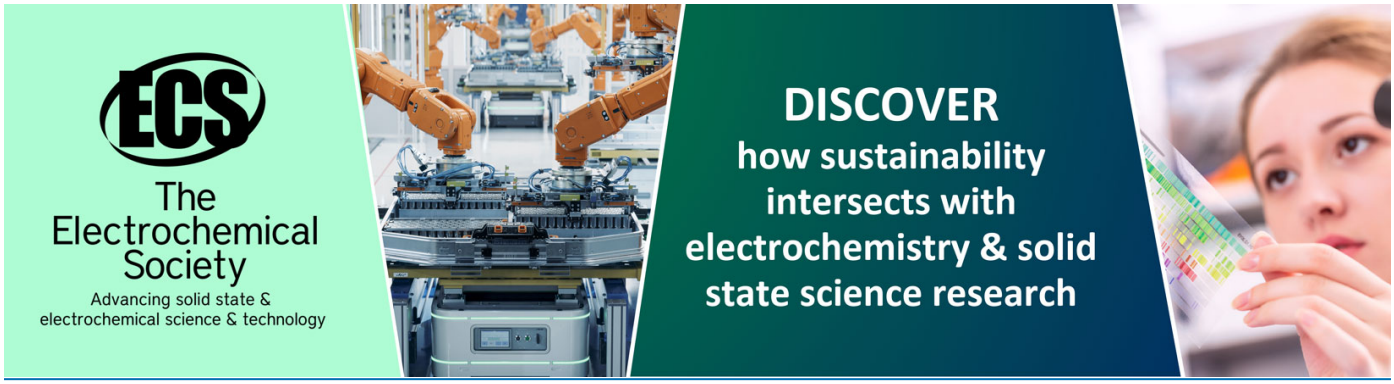

Infectious diseases of poplar (genus Populus) in plantations of Khanty-Mansi Autonomous Okrug – Yugra

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Abstract. The article provides an assessment of the phytopathological state of the genus *Populus* species in various types of plantations of Khanty-Mansiysk Autonomous Okrug – Ugra. It was discovered that the main infectious diseases of poplars in the area are brown cytosporous necrosis (*Cytospora chrysosperma* Pers. (Fr.)), powdery mildew (*Uncinula adunca* (Wallr.: Fr.) Lev.), brown leaf spot (pathogens *Drepanopeziza populorum* (Desm.) Hohn. (= *Marssonina populi* (Lib.) Magnus)., *Septoria tremulae* Pas.). A great spread of the diseases (79.5%) was observed in clean plantings of the same age, where *Drepanopeziza populorum* brown spot is the most harmful. Reduction of the infectious load is facilitated by competent planting formation and advanced agricultural technologies of growing.

1. Introduction

Poplars (family Salicaceae, genus *Populus*) are widely represented in various plantations of Khanty-Mansiysk Autonomous Okrug – Ugra. Black poplar or willow poplar (*Populus nigra* L.) and trembling poplar or aspen (*Populus tremula* L.) grow in natural phytocenoses on moist sabulous silty soils of river floodplains. The plants perform important water protection, water regulation, coastal protection functions in the composition of floodplain forests. Due to their biological features (exuberance, high decorativeness and gas resistance) the plants are widely used for urban landscaping performing important health and hygiene role by improving the chemical composition of urban air. *P. nigra*, *P. tremula* and balsam poplar (*Populus balsamifera* L.) are grown as a part of mixed plantings together with such background species as *Pinus sylvestris* L., *Betula pendula* Roth., *Betula pubescens* Ehrh., *Salix caprea* L., *Salix viminalis* L., *Salix dasyclados* Wimm. during artificial plantation formation. The plantations monitoring revealed a high degree of damage to plants by infectious diseases, 90% of which are diseases of fungal origin (mycoses) [1-4]. The success of the protective measures to aimed at reduction of the infectious load on the cultivations rests upon timely and accurate diagnose of the disease.

The aim of the study is to assess the phytopathological state of the poplars and develop recommendations for the infectious load reduction on the plantations of Khanty-Mansi Autonomous Okrug – Yugra.

2. Materials and methods

Reconnaissance and detailed studies were carried out on various types of plantations on the territories of Surgut, Nefteyugansk, Khanty-Mansiysk.

The plantains assessment was performed employing the conventional procedures [5]. The plant disease prevalence index was assessed on a three-point scale: 1 – up to 25% of leaves were affected; 2 – 25–50% of leaves are affected; 3 – more than 50% of leaves are affected. Based on the results of the detailed examination, disease extension and plant damage intensity were determined [6]. The pathogens diagnosis was carried out according to the method of E S Sokolova [7-8].

3. Results and discussion

In the course of studies on the poplars the following infectious diseases are revealed: brown cytosporous necrosis, powdery mildew, brown leaf spot (agents *Drepanopeziza populorum* (Desm.) Hohn. (=*Marssonina populi* (Lib.) Magnus)., *Septoria tremulae* Pas.).

Brown cytosporous necrosis is caused by the fungus *Cytospora chrysosperma* Pers. (Fr.). Poplar is infested by spores (conidia), which are spread by rain or insects. Multicellular, rod-shaped conidia of the fungus are penetrate the tissues of a healthy plant through various damages and cracks at the base of the branches (figure 1). Mass sporulation of the pathogen occurs in May – early June and late August-September. Dark gray or brown stroma develops in the dead bark, in which pycnidia are formed. They look like numerous conical tubercles on the affected branches and trunks; initially they are covered by the periderm then protrude as stomata from the ruptures of the bark (figure 2).

Figure 1. Conidia of *Cytospora chrysosperma.*

Figure 2. Fungus Sporulation on shoots of poplar black.

The fungus develops in the tissues of the bark, causing individual branches and trunks of plants to dry out. The intensity of disease damage to plants in urban plantings is 20.2%, the spread is 62.1%.

Diseased trees are the source of infection of plantations; the fungus sporulation is formed on their affected shoots. The disease affects various types and hybrids of poplar. Cytosporosis nidus develop on the background of tree weakening, due to unfavorable soil and climatic conditions (drought, prolonged flooding, freezing, nutrients imbalance in the soil), violation of the plantings caring rules.

Powdery mildew is caused by the *Uncinula adunca* fungus (Wallr.: Fr.) Lev. At the beginning of summer, a white powdery bloom appears on aspen leaves (figure 3), then it becomes dense and tomentose, turning black due to the formation of cleistotecia of the fungus [9-10]. In the second decade of July, summer spores of the fungus (conidia) are formed on the affected parts of the plants; which during the growing season provokes a massive infection of healthy young leaves. Conidia are colorless, ellipsoidal or oval, and arranged in chains on unicellular conidiophores. Cleistothecia develop in the first decade of August. The clestothecium appendages are numerous and exceed in their length the diameter of the fruiting bodies themselves; they are simple and twisted or crooked at the ends spirally (figure 4). The clestothecium cavity contains up to 14 bags with elongated or rounded ascospores.

Figure 3. Mealy bloom on aspen leaves.

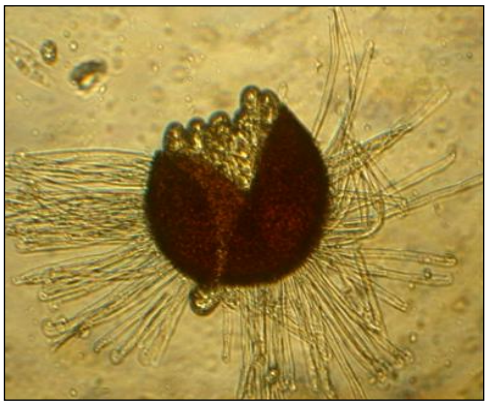

Figure 4. The structure of *Uncinula adunca* fungus cleistothecia.

The fungus passes winter in the form of cleistothecia on infected leaves or on the soil. Ripe ascospores carry out primary infection of plants in spring.

The intensity of the disease in the district greatly depends on the seasonal weather conditions. The disease reaches epiphytotic scale during moderately humid and warm years.

Powdery fungi infest poplars in various types of urban plantations. The disease reaches the highest degree of distribution and plant damage intensity in mixed plantations, on young plants of quivering poplar and balsamic poplar.

The brown spot of poplar leaves is caused by *Drepanopeziza populorum* fungus [7-8]. The causative agent has a conidial stage only. Brown or grey-brownish spots are formed on the leaves of poplar; they are round, up to 5 mm in diameter, with vague edges. The spots often merge covering the entire leaf surface (figure 5). Infected leaves are the source of infection. The first spots on the leaves appear in late May – early June. The incubation (secretive) period of the pathogen is 3-5 days only, so the number of affected trees and the degree of damage to the crown increases very quickly. Initially the leaves of the lower branches are infected, then the infection spreads from the affected leaves to the branches of the middle and upper parts of the crown. Conidial beds of the pathogen are formed on the spots on both sides of the leaf, mainly on the upper one; the conidial beds look like small, yellowish or whitish, round or flat formations. The conidia of the fungus are ovoid, elongate-clavate, pear-shaped, colorless, straight or bent; they are initially unicellular later developing one septum at the base (figure 6).

Figure 5. Spots on the black poplar leaves.

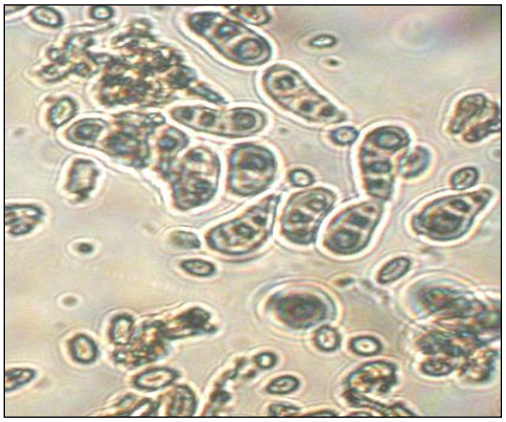

Figure 6. Conidia of *Drepanopeziza populorum* fungus.

The intensity of disease damage to plants in urban plantings is 57.7%, the spread is 79.5%. The weather conditions in the north are favorable for the phytopathogen development. The disease develops intensively in conditions of high air humidity (65–75%) and moderate temperatures (13–18°C) of June-July. The fungus passes winter in the form of fruiting bodies – pycnidia, which have a shell (peridium) and an internal cavity covered with a layer of conidiophores. Conidia are formed in large numbers and soon they fill the cavity of the pycnidia and in the spring come out through a small hole located at the top of the fruiting body.

Poplar is affected in natural and urban plantings. A high level of disease in urban plantings causes premature leaf fall up to a complete loss of poplar decorativeness. The fungus infects various types and hybrids of poplars.

Leaf spot is caused by the *Septoria tremulae* fungus. Numerous, brown, merging spots are formed on aspen leaves in the second half of summer (figure 7). Pycnidia of the fungus develop on the spots on the leaf underside in the form of small, dark brown or almost black dots which contain the spores (conidia) of the fungus (figure 8).

Figure 7. Spots on the aspen leaves.

Figure 8. Picnids as black dots on the spots.

Conidia are colorless, filiform, curved, without septa. They ripen in July and are spread by air infecting nearby trees. The fungus passes winter on the affected leaves in the pycnid form. Conidia re-infect the aspen in the spring. Leaves dry and fall off prematurely. Trees lose their decorative appearance. The disease is more common in forest parks.

4. Conclusion

Thus, taking into account the state of poplars in the urban cultivations, it should be noted that the protective functions of plants are considerably reduced as a result of severe micose infection. The greatest danger to plants is *Drepanopeziza populorum* brown spot, the degree of distribution of which in plantations is 79,5%. Poplars poses varying resistance degrees to the disease: in the north the most susceptible to brown spots is *P. nigra*; *P. tremula* and *P. balsamifera* species have an average degree of resistance to powdery mildew. It is possible to reduce the spread of the diseases in urban plantations with the help of advanced agricultural techniques as well as proper selection of breeds, taking into account the incidence of species by infectious diseases. Thus poplar and birch are affected by the same pathogen that causes the brown spot, which should be taken into account when creating mixed plantation. Creation of the mixed unequal-aged plantations is the most important condition, which ensures their biological stability and limiting spread of diseases. Single-species single-aged plantations create conditions for the dominance of certain types of pathogens, which leads to epiphytotes. Diseased and dead trees retain numerous rudiments of infection in the form of fungal fruiting on their trunks, roots and branches. Therefore the preventive measures of great importance are timely removal of such trees via sanitary cutting and care for plantations.

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