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STERILITY INDICATORS OF PINE PINE POLLEN IN THE AREA OF THE RAILWAY AND AUTOMOTIVE ROAD

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Аннотация: Изучено влияние аэротехногенных поллютантов на мужскую генеративную сферу сосновых насаждений, произрастающих в условиях антропогенного загрязнения вдоль железнодорожной и автомобильной дороги. Установлено, что уровни загрязнения воздуха и почв выбросами способны приводить к снижению стерильности пыльцы растений.
Ключевые слова: сосна; транспорт; дорога; пыльца; аэротехногенное загрязнение.

ПОКАЗАТЕЛИ СТЕРИЛЬНОСТИ ПЫЛЬЦЫ СОСНЫ ОБЫКНОВЕННОЙ В РАЙОНЕ ЖЕЛЕЗНОЙ ДОРОГИ И АВТОМОБИЛЬНОЙ ТРАССЫ

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Abstract: The effect of aerotechnogenic pollutants on the male generative sphere of pine plantations, growing in conditions of anthropogenic pollution along the railway and highway, has been studied. It has been established that the levels of air and soil pollution by emissions can lead to a decrease in the sterility of plant pollen.
Key words: pine; transport; road; pollen; airborne industrial pollution.

The rapid development of transport and the related increase in anthropogenic pollution of the natural environment has an extremely negative impact on forest ecosystems. Forests and protective green spaces, performing an environment-restoring function, normalize the gas composition of the air and reduce the level of its pollution. But the effectiveness of their protective properties can be significantly reduced as a result of exposure to emissions from road transport. The growth of air and soil pollution in the area of railways and highways can cause the death of plants, suppression of their development, a decrease in biodiversity and resistance to stress of roadside ecosystems. Conifers are especially vulnerable due to their high sensitivity to the action of toxicants. And since conifers are often edificator species, their mass death or suppression of development has a significant impact on the functioning of ecosystems [1]. In this case, the generative sphere of plants, which forms the future offspring, is exposed to the greatest danger due to the very high sensitivity to the effects of air pollutants. This can negatively affect the quality of the offspring and further lead to a change in the succession in plant communities.

The aim of this work was to assess the effect of aerotechnogenic pollution on the sterility of pine pollen.

Materials and methods

Plants of Scots pine (Pinus sylvestris L.), the main forest-forming species (edificator) in central Russia, were studied. With its high sensitivity to anthropogenic pollution, this pine species is most often used for biological monitoring [2, 3]. The analysis of studies carried out on pine [4, 5] showed that the reproductive organs of plants are most severely affected by the action of unfavorable factors.

The population of trees (F) growing along the railroad bed and along the highway (T) was studied. Control (K) was assembled in an ecologically clean place 500 meters from the track. The pollen was collected in mid-May (10-30 strobiles from a tree) and stored in the refrigerator. To analyze the quality of pollen, it was stained with a diluted 1: 5 solution of iodine in water. After that, under a microscope Lumam I1, with a magnification of 120 times, the presence of colored and uncolored pollen grains was determined.

The experimental data were checked according to the Dixon criterion for the presence of outliers that were excluded from further consideration. Mathematical processing of the results was carried out by the methods of variation statistics in the Microsoft Office Excel 2007 program. The optimization of the sample size was carried out by the method of statistical analysis of empirical distributions [6].

Results and discussion

The formation of reproductive structures in plants is associated with frequent sequential and rapid cell division. Since the process of cell division is especially sensitive to stress effects, especially with short interphases, plant pollen is widely used for bioindication of the state of the environment [7, 8]. Stress effects of unfavorable factors significantly affect the viability and fertility of pollen grains. The results of long-term studies in several distant regions with different concentrations of air pollutants have shown that toxic gases and dust can increase the sterility of pollen, thereby reducing the efficiency of pollination of plants [9].

The results of the study showed that pollen fertility to the greatest extent, statistically significantly decreases in plants growing along the road. There is a tendency for the decrease in pollen fertility in plants growing along the railway, which is close in level to that of plants from the road (Figure 1).

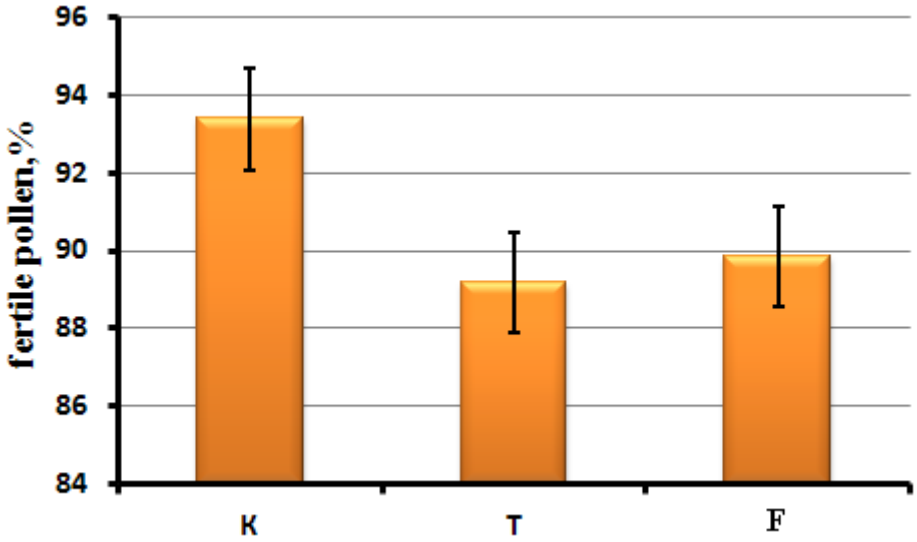

Fig. 1. Pollen Fertility

Conclusions

The results of the study showed that emissions from railway and, above all, road transport can reduce pollen fertility in Scots pine plants.

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