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DUST-COLLECTING EFFECTIVENESS OF *POPULUS NIGRA* L. IN TERMS OF AIR POLLUTION

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Проведена оценка эффективности улавливания пыли из атмосферного воздуха листьями тополя черного. Выявлены различия в степени осаждения пыли в зонах с разным уровнем загрязнения. Тополь черный можно широко использовать в городских насаждения с целью уменьшения уровня загрязнения больших промышленных городов.

Тополь черный, запыленность воздуха, промышленное загрязнение атмосферы, пылеосаждение листьями

Air dustiness is one of the major problems of our time. In recent years in an urban environment there is studied increasing number of waste dust from the transport and industrial factories. The problem of air pollination is associated human diseases such as tuberculosis and allergic diseases [1]. Plants also have a negative impact. Mechanical stomata obstruction of solid dust particles can disrupt the processes of transpiration and gas exchange [2]. Near factories that emitted into the

atmosphere large amounts of dust particles, the linear dimensions of assimilation and growth of the shoots of plants less than 2–5 times in comparison with the plants outside the zone of dustiness [3]. The denser is layer of dust the higher is the temperature gradient of the sheet and therefore a greater consumption of water by transpiration. Increasing transpiration leads to increasing expenditure reserve of moisture in the root layer of soil. Dust penetrate through stomata or cuticular covers in internal tissue, salt solutions, usually in the form of ions is causing structural damage to various tissues and green pigments. The effect of dust can affect the various components of the plant cenoses and that lead to the suppression of growth, the emergence of morphological abnormalities, disappearance unsustainable, changing the chemical composition of soil, destruction of flora, etc. [4, 5].

Most of the dust settled on the surface of leaves, branches, tree trunks and bushes, herbage and delayed, so it stands in the amount 2–3 times less than on non-landscaped areas. Human uses the functions of vegetation in the development and optimization of the urban environment. The leaves of the trees also absorb substances that are released into the atmosphere from factories and vehicles. Dust-collecting effectiveness of trees depends on the specific structure of leaves, namely, their sizes, the total number, the presence of the edge, on the size of crown [6]. The aim of the work is to determine the dust-collecting effectiveness of *Populus nigra* L. in terms of air pollution.

Subjects and methods

The object of work is the *Populus nigra* L., the subject is the dust particles on the surface of the sheet of wood.

To study were selected 4 sections. Section 1 – Naberezhna Street, Ordzhonikidze district. Here there is the impact of transport and industrial enterprises. Number of cars in the period from 12:00 to 1:00 p.m. reaches 1,000 vehicles of which 1% are trucks. Sampling was carried out at a distance of 3–5 meters. Section 2 – along the Lenin Avenue in Zhovtnevy district at a distance of 3–4 meters. The site is characterized by a large influence on road dust emissions, but less influence of factories. Car load is approximately the same as in the previous area. Section 3 – Avtomahistralna highway (outside the city) with heavy traffic of trucks and passenger transport. Number of cars in the period from 12.00 to 01.00 p.m. runs up to 600 cars of which 6 % are trucks. The samples were taken at a distance of 4 to 5 meters from

the road. Section 4 – green area where there is no economic and industrial activities namely Reserve Lysa Hora.

Using the method of determining the dust content of the air by the leaves of the trees [7], we calculated the amount of dust that settles per 1 m² in different areas of the city of Zaporizhia and beyond. In this work was conduct one-time detection of dust. It was examined about 40 trees in different neighborhoods of the city of Zaporizhia and beyond. To assess the degree of dust it was select 10 normally developed leaves from each tree, about the same age, height 1,5–1,8 meters. All leaves were collected from a single tree in a plastic bag with label. The label indicates the number of sample gathering place (making the most detailed binding to the terrain), the date of collection. Gathering places were marked on the map. In addition it was made description of the lamina, the presence of lichens, dry twigs.

Weight of settled dust was determined by flushing, followed by its weighting in the pharmacy scales. Then we counted the number of dust that settles on 1 m². It was calculated by the formula of washed leaf surface (S):

$$S = \frac{M1 \times P}{5 \times M2} (\partial m)^2$$

where M1 – the mass of paper, that was cut to the contours of 5 leaves,
M2 – mass 1dm² paper, P – the number of washed leaves.

Results and discussion

During the experiment it was determined the amount of dust on the 100 sheets of *Populus nigra* L. Knowing the area examined leaves we calculate the amount of dust that settles on one square meter in grams. Results of the study are shown in Table 1.

On average 1 m² of leaf surface of *Populus nigra* L. in Ordzhonikidze district holds about 6,310±1,4 g/1m². The mass of settled dust in the Zhovtnevy district, based on 1m² is 5,071±0,957 g/1m². This is due to the locus of trees, namely the presence of polluting industrial facilities emitted into the atmosphere large amounts of dust particles. The average value of dust on the highway outside the city is 4,017±0,826 g/1m². At this stage the main source of pollution are cars, there is no influence of the industrial factories, so there is less dust particles. The amount of dust per 1m² in

the Reserve Lysa Hora, where there is no anthropogenic impact is not large, only $2,346 \pm 0,695 \text{ g/m}^2$, it is almost three times less than in the Ordzhonikidze district.

Table 1 – Number of dust, leaves delayed *Populus nigra* L. at different sites

Number of section	Weight of dust on 100 sheets(g)	Dust weight per 1 leaf	Number of dust on 1m ² (g)	Area of 100 leaf (дм ²)
1	$2,71 \pm 0,03$	$0,027 \pm 0,006$	$6,310 \pm 1,4$	$430,3 \pm 6,6$
2	$2,09 \pm 0,035$	$0,0209 \pm 0,003$	$5,071 \pm 0,957$	$414,6 \pm 4,4$
3	$1,71 \pm 0,04$	$0,0171 \pm 0,0035$	$4,017 \pm 0,826$	$426,5 \pm 3,35$
4	$0,93 \pm 0,03$	$0,0093 \pm 0,003$	$2,346 \pm 0,695$	$395,6 \pm 3,2$

Based on the data you can construct a diagram of dust-collecting capacity of *Populus nigra* L. in the studied areas (Fig. 1).

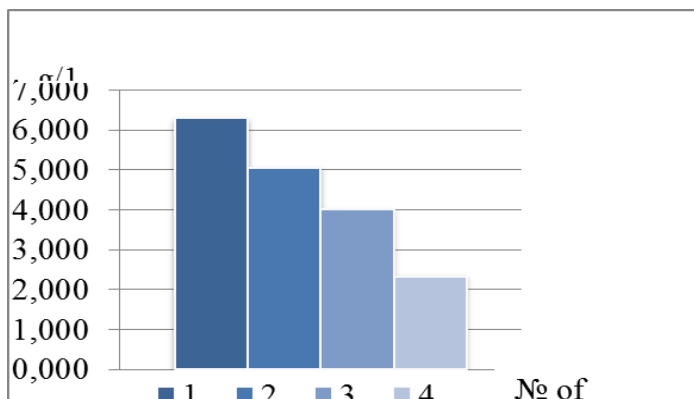


Figure 1 – Dust-collecting ability of *Populus nigra* L. study sites

The chart clearly shows that there is a big difference in the number of deposited dust particles *Populus nigra* L. leaves in different areas of the city and beyond. Number of dust particles on the leaves of

the first portion is almost three times larger than the fourth section of the study.

Conclusions

1. A large amount of dust in the first two sections connected with a place of growth of the trees, namely with the presence of polluting industrial facilities that emitted into the atmosphere large amounts of dust particles.

2. In the second section the main source of pollution are cars, there is no influence of the industrial factories, so there is less dust particles.

3. The amount of dust in the territory of a fourth area, where there is no anthropogenic impact is not big almost three times less than the area number 2.

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