

THE IMPACT OF SOME AIR POLLUTANTS ON THE VEGETATION NEARBY THE INDUSTRIAL PLATFORMS

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ABSTRACT. The impact of some air pollutants on the vegetation nearby the industrial platforms. Plants are affected primarily by air pollution. This is generated by the accumulation in the atmospheric air of gaseous-chemical compounds or solid particles in the form of powder, which are then deposited on the ground. The gaseous pollutants result from industrial activities, such as the sulphur compounds (SO₂, SO₃, H₂S, carbon sulphide), nitrogen oxides (NO, NO₂) and carbon (CO and CO₂). The impact of air pollution can cause severe damages to the plants located near industrial areas, especially because the most Romanian thermal power plants were built in a period when their operation impact on the environment was undervalued, and the constraints related to the environmental protection were relatively few. The pollutants enter plants through stomata causing a reduction of metabolic processes. The study has been conducted during 2010-2012 in Craiova City, in the area of the powerplant CET I – Isalnita, on 15 species both annual and perennae from spontaneous plants in the influence area. The observations were particularly conducted for the following purposes: identification of the inflicted organs (leaves, stems, branches); percentage of the organs inflicted; the pollutant implied; to answer what kind of pollutant is implied; to classify the species with regard to their sensibility to the studied pollutants, respectively: NO₂, SO₂, PM₁₀. The main result of this study are: the main pollutants, which affects the vegetation are SO₂, NO₂ and particulate matter, this pollutants affecting more the leaves than the stems of the plants, the number of individuals affected varies between 15-70 %; the following species can be considered as bioindicator: *Pinus nigra*, *Urtica dioica*, *Phaseolus vulgaris*.

Key words: air pollution impact, industrial platforms, vegetation, morphological analyses

1. INTRODUCTION

Urban and industrial human activity have a pollutant effect on the environment, directly proportional to the specific activity, visible in areas more or less extended and dependent to a great extent on climatic conditions. The distribution and atmospheric processes of pollution and its effects on environment are influenced by climate, topography, demography, and socioeconomic profile of the region (Ilten and Selici, 2008).

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The main sources of pollution are industry, agriculture, transport and human communities. They cause air, water, soil and biosphere pollution. Plants are affected primarily by air pollution. This is determined by the accumulation in the atmospheric air of gaseous chemical compounds or solid particles in the form of powder, which are then deposited on the ground.

The gaseous pollutants result from industrial activities, such as the sulphur compounds (SO_2 , SO_3 , H_2S , carbon sulphide), nitrogen oxides (NO , NO_2) and carbon (CO and CO_2). Sulphur and nitrogen oxides are combining with water in the atmosphere forming H_2SO_4 and HNO_3 acids, which fall on the plant as acid rain. Other pollutants are compounds and substances as NH_3 , HCl , Cl , F etc.

Hydrocarbons, aldehydes and cetones from various industrial activities are transformed in the presence of sunlight in gaseous pollutants such as acids, ozone or benzopyrene.

Accumulated solid particles in the atmosphere are represented by charcoal, ashes, dust of heavy metals (Cd , Cu , Zn , Hg , Pb) and light powder (lime, gypsum, cement). They are originated in different kinds of industry or in transportation. They fall on plants or on soil where cause a high degree of pollution.

The pollutants enter plants through stomata causing a reduction of metabolic processes. The atmospheric pollutants cause perturbation of physiological processes, which consist in the production of cellular and tissue damage, metabolic and growth disorders, full drying of plants. Absorption is limited by stomata conductivity and cuticle conductivity: the absorption intensity is directly related to the stomata opening degree and cuticle permeability. In cells and tissues, pollutants cause chloroplasts, ribosomes and other organelle toxicity, and corresponding reduction of metabolic processes.

As external impact, the action of pollutants produce visible symptoms, especially on the leaves. Considering the colour of leaves we can identify the pollutant. First, the leaves are etiolated, then are necrosated, and finally they are completed dried and fall.

The study has been conducted during 2010-2012 in Craiova City, in the area of the CET I – Isalnita powerplant, on 15 species both annual and perenae from spontaneous plants in the influence area. The major sources of air pollution in the city of Craiova are represented by anthropogenic activities, which can be classified in 3 categories: traffic, with specific pollutants emission from the combustion of fuels; various industrial activities with pollutant emissions like gases, water vapors or particulate matter - specific to different technological processes; specific urban activities with emissions mainly due to fossil fuel combustion (Popescu and Gavrilescu, 2012).

2. THE ANALYSIS OF AIR QUALITY AND THE EFFECTS OF AIR POLLUTION ON THE PLANTS IN THE AREA OF INDUSTRIAL PLATFORMS

The impact of air pollution can cause severe damages to the plants located near industrial areas, especially because the most Romanian thermal power plants were built at a time when their operation impact on the environment was undervalued, and the constraints related to the environmental protection were relatively few (Popescu et al, 2012).

The presence of Isalnita industrial platform (Fig. 1) near a dens populated area (Craiova City) has a major impact on all the economic fields in the area. Among the pollution effects the air pollution is one of the main parts of the environment that is most important.



Fig. 1. CET I Isalnita, Craiova

Through the activities profile, the input and the output products, the technologies that are used, the Industrial platform must be taken as important possible pollution issue in the area.

The climate of Craiova city is temperate continental, with mean annual temperature of 10.7° C. For July and August the mean temperature reaches 22,2 °C, and 21.7 °C respectively . The annual rainfall amount is of 569.9 mm; the most rainy months are June and May, with monthly mean of 70.2 mm and 63.4 mm respectively (Sandu et al., 2008).

This study has been conducted during 2010-2012 on 15 species both annual and perennae from spontaneous plants in the influence area. The observations were particularly focused on the following purposes: identification of the inflicted

organs (leaves, stems, branches); percentage of the organs affected; the pollutant implied; finding the answer of what kind of pollutant is implied; to classify the species with regard to their sensitivity to studied pollutants, respectively: NO₂, SO₂, PM₁₀.

Air quality monitoring was performed using a portable multigas detector Oldham (Model MX 21 – Plus Multigas, France) and the assessment of the effects of air pollutants on the studied plants was achieved by tracking some morphological indicators.

The pollutants input in the atmosphere (mean values) are presented in Fig. 2.

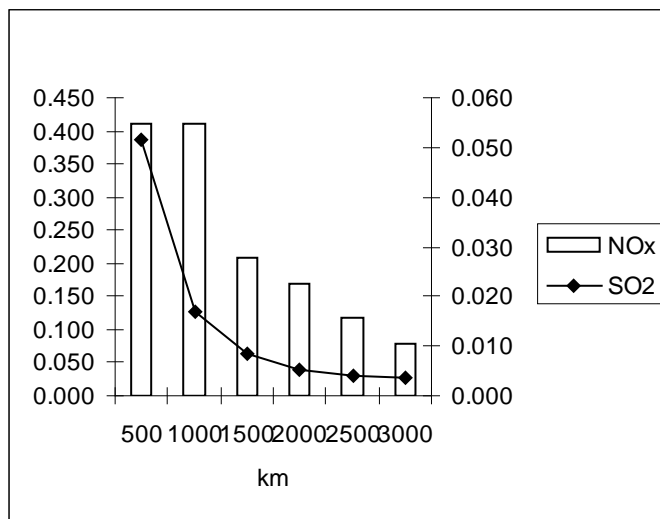


Fig. 2. The concentration of pollutants (NO_x and SO₂) discharged from Isalnita Industrial Platform (mg/m³)

Under these conditions the percentage of affected leaves of the studied species is between 15-75 %, the area of pollution has an extension of 0,3-0,7 km in diameter. It is obvious a higher degree of affected leaves, the species *Pinus strobus* – 75 % (3rd type of pollution – heavy); *Phaseolus vulgaris* – 50 % (2-nd type of pollution – dangerous); *Salix purpurea* – 15 % (first type of pollution – obvious) (Fig. 3).

Considering the degree of affected bodies we observed for the species *Abies alba* and *Pinus nigra* (2-nd type of pollution – dangerous) that 50 % of the plant population were injured at. The less affected were the bodies of the species *Alnus glutinosa* (2%), *Buxus sempervirens* (5%) and *Pinus strobus* (5%) (first type of pollution – obvious) (Fig. 4).

This species were affected especially about the pollutants, which contains a higher concentration of SO₂. The reaction of this pollutant with the atmospheric water vapours results in acid rain, which conduct at the necrosis of the vegetation with implication on the metabolism of plants.

From the total of the individuals, which were considered for this study, 75% belong to the *Pinus strobus* species, 70% to *Phaseolus vulgaris*, whereas a minimum number of individuals affected belong to the specie of *Salix fragilis* (15%) (Fig.5).

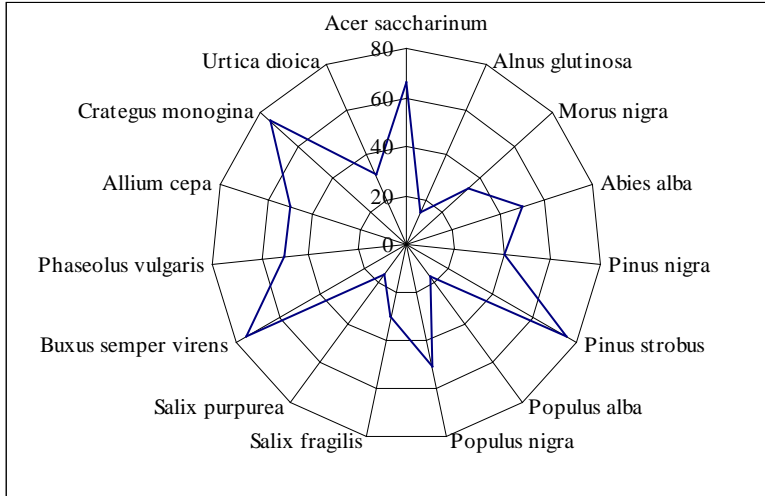


Fig. 3. The influence of the pollutants on the leafs percentage on the studied species

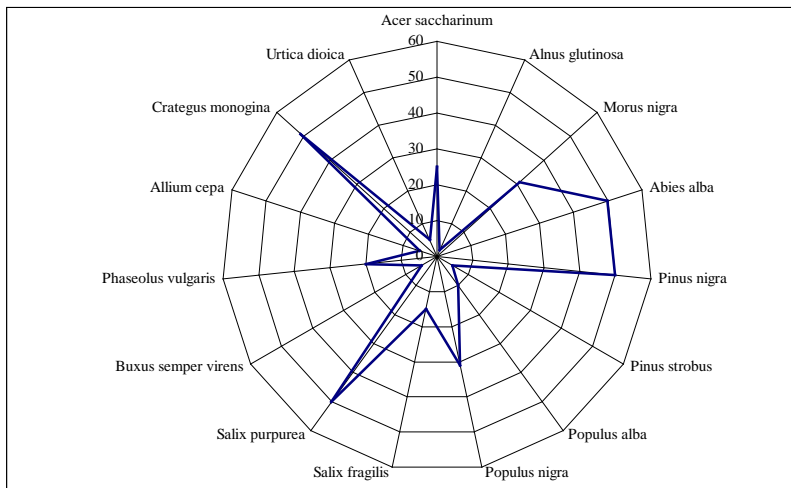


Fig. 4. The influence of the atmospheric pollutants on the bodies percentage of studied species

3. CONCLUSIONS

The study highlights that the pollutants emissions of the thermal power plant affect the environment and the plants located in the vicinity of the industrial platform.

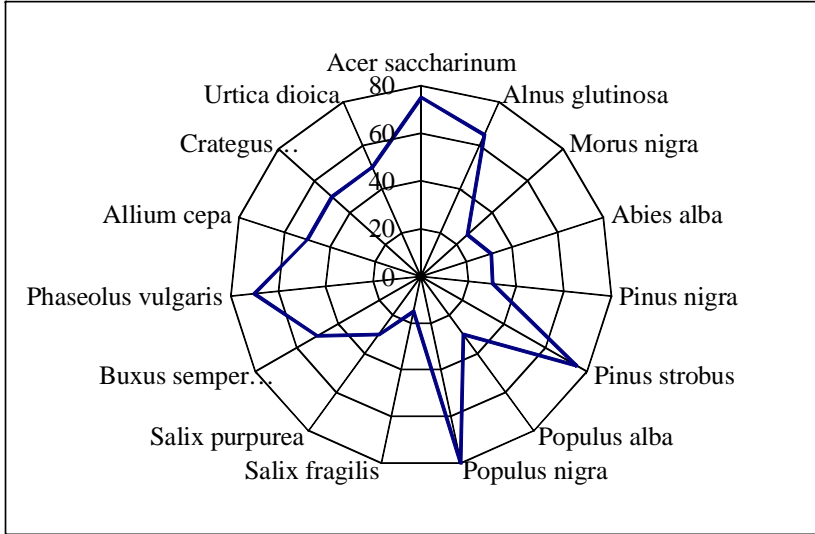


Fig. 5. The influence of the atmospheric pollutants on the species affected percentage



Fig. 6. Trees affected by the pollution in the area of Isalnita Industrial Platform

From this study it results:

- the main pollutants of Isalnita industrial platform, affecting the vegetation are SO₂, NO_x and the sediments;
- this pollutants affect more the leaves than the bodies of plants and the number of individual affected varies between 15 and 70%;
- the majority of species belong to the second type of pollution (dangerous);
- the following species can be considered as bioindicators: *Pinus nigra*, *Urtica dioica*, *Phaseolus vulgaris*.

In the case of areas exposed to atmospheric pollution, it is absolutely necessary to take measures of air depollution, so that the pollutants entering into the atmosphere by various industrial sources, as it is the case for the studied area, do not affect the integrity and productivity of plants.

For a better understanding on how the air pollutants affect the plants further physiological analysis are necessary and also the concentration of the air pollutants emitted into the atmosphere must be correlated with the climatic condition for the specific area.

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