ECOLOGY

ENVIRONMENTAL POLLUTION WITH HEAVY METALS AND SELECTIVE SENSITIVITY OF SOME SPECIES OF MEDICINAL PLANTS

[1]*Associate prof.* ***N. Asanidze,***
[2]*Assist. Prof.* ***N. Alasania,***
[1]*Candidate of Agricultural Sciences* ***L. Ebralidze,***
[1]*Assist. Prof.* ***L. Gorgiladze***

[1]*Georgia, Batumi Shota Rustaveli State University, Department of Agroecologist and Forestry*
[2]*Georgia, Batumi Shota Rustaveli State University, Department of Agrotechnology & Engineering Department*

DOI: https://doi.org/10.31435/rsglobal_sr/30062019/6541

ARTICLE INFO

Received 20 April 2019
Accepted 24 June 2019
Published 30 June 2019

KEYWORDS

Cadmium cd,
fraction,
phytotoxicants,
Pollutant,
Concentration,
Medicinal plants,
Bidens.

ABSTRACT

Heavy metals are especially dangerous in the registry of polluting agents of the environment, as the heavy metals are hazardous to human health and it is particularly dangerous because getting the heavy metals into the living organism is a provocative factor of the dangerous disease such as malignant tumors, diseases of cardiovascular system or nervous system.
The problem of the environmental pollution with heavy metals is a priority and urgent problem. Therefore, we aimed to study the peculiarities of the accumulation and dynamics of heavy metals in the polluted and clean environment in different types of medicinal plants grown in Adjara region. The study of annual absorption of heavy metal in the medicinal plants, I think, will have a practical value, because since we often use medicinal plants to help prevent different diseases, it is possible to provoke another disease. Through the plants we used to study.

Citation: N. Asanidze, N. Alasania, L. Ebralidze, L. Gorgiladze. (2019) Environmental Pollution with Heavy Metals and Selective Sensitivity of Some Species of Medicinal Plants. *Science Review*. 5(22). doi: 10.31435/rsglobal_sr/30062019/6541

Introduction. The pollution of our environmental environment, including the atmosphere, is one of the global ecological problems of modern life. Its result is the global ecological problem that is global warming. Global warming trends are apparently worrying, no sensible person has any doubt in this, but fortunately there is a potential opportunity to get out of this standoff. The other thing is who and how will use these abilities.

Heavy metals are especially dangerous in the registry of polluting agents of the environment, as the heavy metals are hazardous to human health and it is particularly dangerous because getting the heavy metals into the living organism is a provocative factor of the dangerous disease such as malignant tumors, diseases of cardiovascular system or nervous system. In the last decades of the twentieth century, the industry gave the first place of air pollution to transport. With the calculation of the US National Academy of Sciences, four thousand people die every year because of air pollution by the transport. Annually, among the types of transport the air pollution is mostly caused by the motor vehicles, the share of which in some cities may reach 90%. For example, in some cities of Georgia, e.g. in the capital

Tbilisi, according to the latest data, 96.6% of air pollution is caused by motor vehicles (T. Zhorzholiani E. Gordadze (protection environment and rational appliance of resources) pp 200-201.

Among the contaminants of the motor vehicle, it is especially important to note the substances that are derived from the depreciation of tires and soils, such as Cadmium cd, Ferrum Fe, Plumbum Pb, Nickel Ni, Zinc, Zn, etc. The Cadmium is excreted when the car tires and asphalt concrete are depreciated. Cadmium and lead are the strongest polluting agents of the roadside environment. It is estimated that 75% of the lead which is included in the fuel is emitted in the air, quickly spreads and pollutes the soil and air. At a very long distance from the highway, a large fraction is quite active, which pollutes the soil from 5 to 1000 m. On both sides of the highway, the smaller particles that contain the lead are moved over long distances by the flow of air. The length of their transfer depends on the weather conditions and the wind direction. The soil contamination with the lead reaches the depth of 10-15 m., sometimes 20 m. The lead content in the soil up to 50 mg / kg is a dangerous indicator for the human health. It is collected in tropical chain rings and achieves quite high doses.

From the literary sources it is known that the phytotoxicants in the environment, including metals excess concentration, have negative impact on the plant, but, on the other hand, due to the physiological characteristics of the plant itself, individual species and varieties have different sensitivity to a particular pollutant (Nokrovokaya 1983).

Naturally, there is a question about the impact of excess heavy metals on the human body. The accumulated heavy metal in the plant meets the human body and, perhaps, causes a number of anomalies. N. Nemsadze studied Dynamics of heavy metals (Fe, Zn, Mn, Cu, Pb) in the industrial and recreation zones of Tbilisi as well as in the leaves of some of the trees along the highways during the vegetation period.

An interesting research has also been made by N. Nikabadze and A. Shatirishvili. They studied the inter-popular genetic polymorphism caused by heavy metals in local populations of wine yeast. Thus, the problem of the environmental pollution with heavy metals is a priority and urgent problem. Therefore, we aimed to study the peculiarities of the accumulation and dynamics of heavy metals in the polluted and clean environment in different types of medicinal plants grown in Adjara region. The study of annual absorption of heavy metal in the medicinal plants, I think, will have a practical value, because since we often use medicinal plants to help prevent different diseases, it is possible to provoke another disease. Through the plants we used to study, we studied the most common medicinal plants in our region, such as: Eucalyptus and Hypericum.

Eucalyptus – The plant belongs to myrtle family. It combines more than 600 species. It is a fast-growing, evergreen, light-loving tree or a bush and blooms abundantly. It creates sparse groves and grows up to 150-160m, which is about 4-5 meters thick. A trunk is straight or curve, smooth or corrugated; leaf is quite simple and rough. Some species are covered with a waxy flake; Flowers are hermaphroditic, it is white, rarely yellow or dark red. The fruit is a box, the seeds are multifaceted and thin, the crown is pyramidal and egg-shaped. Its leaf contains precious ether oils and the crust contains up to 40% tanning material. It grows well on different types of soil and cannot adapt to saline soils and dry sand. It is multiplied with seed or shoots. In natural conditions, eucalyptus is spread in Australia, Tasmania and New Guinea Islands. It is spread in the subtropical zone of the Black Sea coast. Since the 1880s, in Georgia, about one hundred species of eucalyptus, as decorative plants are cultivated. The best species of eucalyptus are: Osier Eucalyptus, Eucalyptus Mccarthy, Sphere Eucalyptus, Blue Eucalyptus, Delegate Eucalyptus and others. Eucalyptus bark is used in shipbuilding, internal framing of the building, making furniture, and so on. The ether oils from the leaves are used in medicine, perfumery and others. In Georgia it reaches 25-30 m during 20-25 years. It can withstand freezing temperatures relatively well but dies during strong frosts. Eucalyptus leaves are therapeutic raw materials that are collected at any time of the year, preferably in autumn-winter. The leaf has an aromatic odor and bitter taste. They are dried in the shade or in the drier at no more than 30^0C. (Natela Varshanidze, Narguli Asanidze; medicinal plants spread in Adjara and their bioecology). Ether oils obtained from eucalyptus leaves are used as a bactericidal method for the treatment of gum inflammation as well as during respiratory tract disease, in particular, during coughing, bronchitis pulmonary gangrene and angina. In medicine besides the spherical eucalyptus, blue eucalyptus (eucalyptus cinezea muell) and manana eucalyptus are also used for the same purpose. (E. Viminalis Zabiela).

Hypericum – the perennial, rarely annual plant like grasses and shrubs from the Hypericum family. More than 300 species are spread in moderate and subtropical districts, mostly in the Mediterranean and in the tropics. There are 19 species in Georgia. Normal Hypericum (Hypericum perforatum) is a widely spread plant. Its land-based parts are dried and medical solutions are made (containing tanning substances and ether oils). Antibiotic Novomin is received from it. Some species

of Hypericum are poisonous for sheep and horses. Many species are cultivated as a decorative plant. The preparations made of Hypericum are also used during acute and chronic colitis, gastrointestinal disorders, gallbladder and biliary diseases, kidneys, chronic inflammation and gynecological disease. Chemical content − grass contains hyperosides, rutin, quercetin, ascorbic and nicotinic acids, saponins, tanning substances, choline, phytoncides and alkaloids.

Plantago – this plant belongs to a Plantago family. They are annual or perennial grasses, sometimes bushy. This species consists of up to 250 varieties that are spread in the earth's temperate zone. There are 11 species in Georgia. They grow on the dry and grassy slopes of the alpine and semi-alpine or coastal areas. Plantago major, plantago media and plantago lanceolata are the most common species on roads and littered places, meadows and rocky areas. Plantago seeds contain mucus and glycoside aucubin, leaf contains carotene, vitamin and phytoncides. The leaf is used for curing wounds and ulcers. The solution is used as a means expectoration and juice – for curing gastritis and enzyme.

Bidens – the variety of annual or perennial herbaceous plant of the family of compositae. It combines more than 200 species. It is spread all over the earth, and the largest share of the species - in America. Only 3 species are growing in Georgia, Bidens bipinneta is from North America and is found in the ruderal places and coastal zone. Bidenstripartira is used in folk medicine. Its trunk and leaves are used to make the yellow paint for the shawl. It grows on the coastline and foothills in marshy and wet areas. Sometimes it is a garden weed with a height of 15-60 cm, rarely up to 100 cm. It has a strong root system and the stem is straight. Dark green leaves with short petioles are located on the stem opposite each other. The roots of the petioles are tied to each other, the leaf is notched, the flowers are placed on the ends of the branches. Its outer leaves are green, elongated. The inner row leaves are grayish-yellow and oval. Flowers are tubular, hermaphroditic, yellowish seeds are bristly and barbed, with two sharp pappi at the end, which are easily stuck to the animal's fur, man's clothes and easily spread.

The goal and objectives of the research. In this case, our goal was study medicinal plants: Eucalyptus, Hypericum, Plantago and Bidens. (It is known that these plants are quite frequently used for the treatment of various types of diseases) and find out if one disease is cured by the root system of these plants or by certain parts of the stem and in parallel to find out the concentrations of hard metals by chemical processing of root and leaf solutions which may be a provocative factor for other dangerous diseases.

Our aim was to describe the annual dynamics of heavy metals and to find out the selective sensitivity to the various medicinal plants mentioned above, as well as other species, for instance, in citrus (N. Asanidze 1999) or in pyramidal poplar leaves (N. Nemsadze 1997). We made the research in the following way: we collected the above-mentioned plants in the vicinity of the highway.

Sampling. We took samples in early spring, in dry weather. In case of precipitations, sampling should stop and continue after three dry days. In the morning the samples can be taken after the complete disappearance of the dew. The plants affected by fungus disease or insects cannot be used.

500 g. of the leaf of above-mentioned plants are should be dried in the air, in the shade, so as not to touch the metal, newspaper or dust. After drying it should be put in a glass vessel. For determining heavy metals, the material should be crushed in porcelain basin and defined by a spectral method.

Table 1.

Research results (Spring)

Sample names	Copper mg/kg	Lead mg/kg	Cadmium mg/kg	Zinc mg/kg	Iron mg/kg
1. Eucalyptus	5.5	1	0.01	14.0	260
2. Hypericum	16.5	9.0	0.01	17	990
3. Plantago	3.05	9.5	0.01	20.02	600
4. Bidens	22.5	10.05	0.01	23.0	210
Sample names	Copper	Summer Lead	Cadmium	Zinc	Iron
5. Eucalyptus	5.9	1.2	0.02	16.0	262
6. Hypericum	17.2	9.7	0.02	17.5	995
7. Plantago	3.15	10	0.01	20.5	605
8. Bidens	23.4	11	0.01	23.5	212.0

Autumn

Sample names	Copper mg/kg	Lead mg/kg	Cadmium mg/kg	Zinc mg/kg	Iron mg/kg
9. Eucalyptus	6.5	1.5	0.03	17.0	265
10. Hypericum	18.0	10.0	0.02	18.0	1000
11. Plantago	3.63	10.9	0.01	22	609
12. Bidens	24.3	11.4	0.015	24.0	214.0

It is noteworthy that the plants we study grow in the adjacent areas of the motorway and in addition to the motor vehicle exhaust they are polluted with other pollutants as well, namely, residents of this area use fuel and coal for warming, which is the second pollutant source of the environment. The wind direction and height are of great importance to the transition of atmospheric pollutants to the environment from one place to another and in other directions.

As our research shows, the annual dynamics of heavy metals in the above-mentioned special plants are as follows: From spring to autumn, the content of heavy metals (copper, lead, cadmium, zinc and iron) increases. From the results obtained, it is especially important not only to determine the abovementioned regularity, but also selective sensitivity of these plants towards these heavy metals. Namely, the most sensitive to the lead among the above-mentioned medicinal plants is Hypericum, Plantago and Bidens. But Eucalyptus turned out to be resistant to the lead, but none of the plants above were sensitive to the cadmium. In the case of zinc all four medicinal plants, Eucalyptus, Hypericum, Plantago and Bidens are particularly sensitive. As for the iron, Bidens is characterized by the lowest sensitivity to the medicinal plants and Hypericum – by the highest one.

From the results we have received, it is particularly noteworthy that special sensitivity to the lead has been found in the Hypericum, Plantago and Bidens, and Eucalyptus has relatively low sensitivity in relation with the pollutant. However, the sensitivity to the zinc is higher in eucalyptus, Hypericum, Bidens. As for the cadmium, the concentration of this pollutant is low in all four plants. At the same time, there seems to be some regularity between the accumulation of atmospheric pollutants in the above-mentioned medicinal plants and the seasons of the year, (increasing from spring to autumn and reaches a m-aximum in autumn). Such regularity was studied by N. Nemsadze and N. Asanidze in coniferous and citrus plants (1990, 1999).

Heavy metals can be accumulated through the root system as well as through filtered penetration (Roberts 1971). It is possible that Eucalyptus, Hypericum, Plantago, Bidens are accumulating heavy metals from the environment using the both means. This process is especially intense in autumn as this time the amount of atmospheric sediments is increased and the heavy metals collected in the atmosphere during the whole spring and summer fall on the ground together with the rainfall. We took medicinal plants in the vicinity of the highway. Atmospheric air is more contaminated in the vicinity of the road than in the area away from it because the carbon emissions have large concentrations of leads, so in plants that are sensitive to the lead, we can clearly outline plant indicators that are sensitive to this pollutant of the atmosphere: 1. Bidens, 2. Plantago, 3. Hypericum. It is known that environmental pollutants are actively reaching the leaves through the mouths, but plants have the ability to regulate the flow of atmospheric pollutants into leaves through mouths. (Heck 1968, Lee 1965, Majemic 1971, Aronson 1972).

Conclusions − our research shows that:

1. Like other species of plants, medicinal plants are characterized by sensitivity to a variety of pollutants of the environment, especially of such hazardous pollutants such as heavy metals.
2. Medicinal plants – Hypericum, Plantago and Bidens can be used as a bioindicator of pollution of the environment with leads.
3. Medicinal Plants: Bidens, Plantago and Hypericum, which grow in the nearby area of the motorways and in the lead-contaminated environments, cannot be used for medicinal purposes due to high concentration of lead in them.

REFERENCES

1. N. Varshanidze, N. Asanidze, N. Turmanidze, E. Jakeli, „Medicinal Plants Spread In Adjara And Their Biochemistry " Publishing house – Universal. Tbilisi 2014
2. Nemsadze - „The impact of Basics Heavy Metals in plants and bases Accumulates basic supplies. Proceeding of the International Scientific Practical Conference Dedicated to 100th Anniversary of Batumi Botanical Garden. Batumi, Georgia, 8-10 May, 2013,
3. Nemsadze «In Some of the Growing Plants Growing in Tbilisi For the Study of Heavy Metal Accumulation», Scientific Scientific Symposium on Plant Morphology, (Materials) Tbilisi, Vejini 1990 p. 29
4. Makinen A. –Sphagnum mossbags inairpolluzion monitoringin tnte ciry of Helsinri: Proc. AB.Cont. Broecol, Byalapest Vaeratot, 1995.pt. B, Bydapest.