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A.T.Nurkenova, O.A.Abdrakhmanov, A.Zh.Shaibek

E.A.Buketov Karaganda State University

ACCUMULATION OF LEAD IN THALLOMES *PARMELIA VAGANS* NYL. IN THE ENVIRONS OF KARAGAILY ORE-DRESSING AND PROCESSING ENTERPRISE

Мақалада авторлардың өзіндік зерттеу нәтижесі бойынша Қазақ ұсақ шоқыларында өсетін қына флорасына талдау жасалған. Қоршаған орта мен қорғасын құрамын анықтайтын биоанықтағыш ретінде қына ролі анықталған. Олардың халық шаруашылық мәні баяндалған.

В статье дан анализ лишенофлоры Центрально-Казахского мелкосопочника по результатам собственных исследований. Определена роль лишайников как биоиндикаторов состояния окружающей природной среды и содержания свинца. Описано их народнохозяйственное значение.

The main condition of creating material and technical base nowadays is the comprehensive studying and application of animate nature resources. Science requires conducting profound researches of the vegetable kingdom for its fuller application in the agriculture.

In the present time the main task of botanic science is studying totally our natural vegetable resources. Therefore the role of investigation of different groups of plants increases including those ones that were not used earlier.

Now interest is increased to cryptogamous plants as a source of raw materials for some fields of industry and also as an extra source of food and fodder resources. The bases for possibility of practical application of different groups of cryptogamous plants serves their deep and comprehensive floristic studying that is finding out the exact specific structure of definite territory, their geographical extension and ecological peculiarities. They must include not only those groups of plants.

The studying of specific structure of lichen helps to define a biodiversity of Karaganda region. Some kinds of lichen can be used as indicators of ground waters, rocks, soils and other natural processes and phenomena. The definition of hard metal accumulation in thalloms of lichen gives sufficient, reliable information about the environment condition. They give opportunity to use methods of lichen indication on our region.

The loss of alley plantation in consequence of landscape urbanization in many localities and disappearance of old trees, and also negative influence of industry enterprises on vegetation means the loss of specialized kinds of lichen. Along with the reduction of air pollution the purposeful program of stimulation and conservation of vegetable resources can increase chances of lichen to survive [1].

In the organization of ecological monitoring of environment the lichens established a reputation as more informative and economical object long ago. Many experiments established the ability of lichen to accumulate different elements radionuclides and hard metals. And every kind of lichen has selectivity applying to separate elements. All these peculiarities on lichen are unique foundation for application of this group of plants to solve problems of quality of ecological condition of nature and estimation of anthropogenic load in ecosystems [2].

During the scientific work accumulation of lead in thalloms of lichen and bioecological peculiarities of lichen.

Among many negative consequences of economic activity of human society the environment pollution by group of pollutants taken general name hard metals takes the special place.

– Ability of hard metals to catalyze numerous organic and inorganic reactions is one of the main characteristics of this class of compounds in the problems of nature environment. This property of transitional, capable to change its level metal oxidation — Cu, Fe, Ni, Cr, Co practically all, especially widespread and precious — Pt, Pd heavily complicate understanding of different chemical conversions of any substrates in different fields.. Ability of hard metals to catalysis of chemical reactions in biosphere makes practically unpredictable the character of ecological danger. When the reaction flows spontaneously, in the presence of several metals, and along with other unidentified reactions the situation is rather difficult. Chemical reactions, capable to flow in surrounding natural environment under the influence of hard metals is the cyclization, isomerization, polymerization, hydrogenation, hydroformylation, carbonization etc.

All enumerated processes can lead to dangerous consequences for living organisms [3].

In different environments types of interactions of metal-organism have general mechanisms: hydrolysis, photolysis, oxidation, restoration, formation of other forms, decomposition under the influence of microorganisms etc. Straight and reverse migrations of hard metals from the soil into adjoint environments are considerably defined by the processes taking place in the boundaries of different environments and they are sorption and desorption, evaporation and repeated settling on the surface, accumulation in the thallomes of plants, in silt, change to water etc.

Any organism reacts immediately on increase of hard metals ion concentration, coming in sufficient quantity for example with food. It is supposed that incoming necessary metal saturate their binding places and do not react, optimal level covers wide interval of concentration for different ions of hard metals.

Not all hard metals represent similar danger for biota. By their toxicity, widespread, ability to accumulate in food circuitry only more then ten elements are defined priority biosphere pollutants liable to immediate control. Among them mercury, lead, cadmium, arsenic, copper, vanadium, tin, zinc, antimony, molybdenum, cobalt, nickel. By the level of danger they are divided into three classes. Lead is apply to the 1st class — specially toxic substances [4].

The objects of research for estimation of environment condition of Karkaralinsk district serve tests of lichens from the territory of ore-dressing and processing enterprise near Karagaily of Karaganda region on the slopes of mountains in the environs of anthropogenic-polluted place.

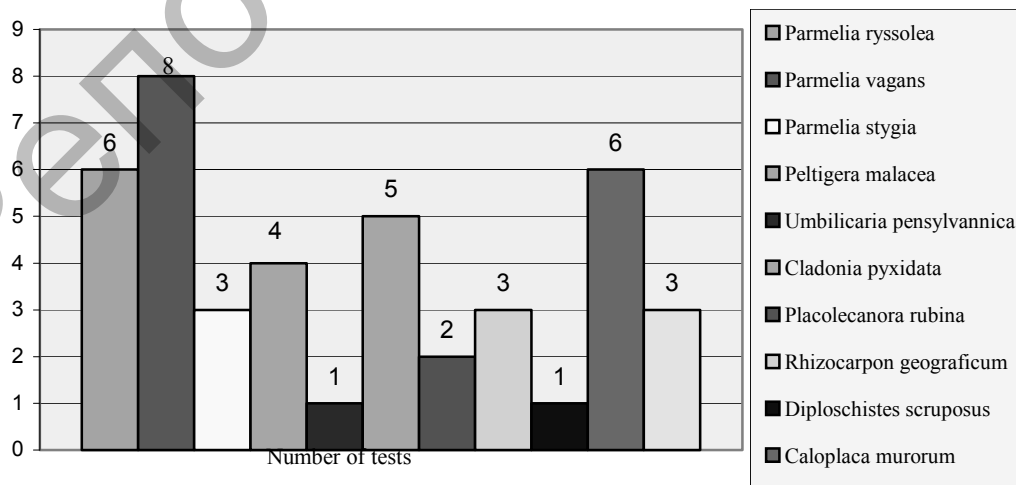
Lichens were chosen in four directions: East, South, West, North from Karagaily ore-dressing and processing enterprise in radius of 3 km from epicenter. Altogether by all points 42 tests of lichen were chosen. Only abundantly growing kinds were chosen they only 11.

По общепринятым методикам было проведено определение видов лишайников и их систематизация.

By generally accepted methodology the definition of kinds of lichens and their systematization were made.

Picture 4

Abundance of lichen — dominants in outskirts of Karkaralinsk



Analysis of lichen flora by own research showed that lichens of Karkaralinsk district have widespread and thus about 35 kinds of lichen were defined it is 36 % from total sum of Karaganda region lichens. From defined ones 11 dominating kinds of lichen were found and systematized: *Parmelia ryssolea* (Ach.) Nyl., *P.*

stygia (L.) Ach., *P. vagans* Nyl., *Peltigera malacea* (Ach.), *Umbilicaria pensylvanica* (Ach.) Hoffm., *Cladonia pyxidata* (L.) Hoffm., *Placolecanora rubina*, *Rhizocarpon geographicum* (L.) Dc., *Diploschistes scruposus* (Schreb.) Norm., *Caloplaca murorum* (Hoffm.) Th. Fr., as a result definite lichens were added to 5 orders, 7 families, 9 kinds. The larger part of sorts are applied to order LECANORALES (4 kinds).

Large specific variety among lichens is a kind *PARMELIA* Ach (3 sorts). Other kinds have small quantity of sorts.

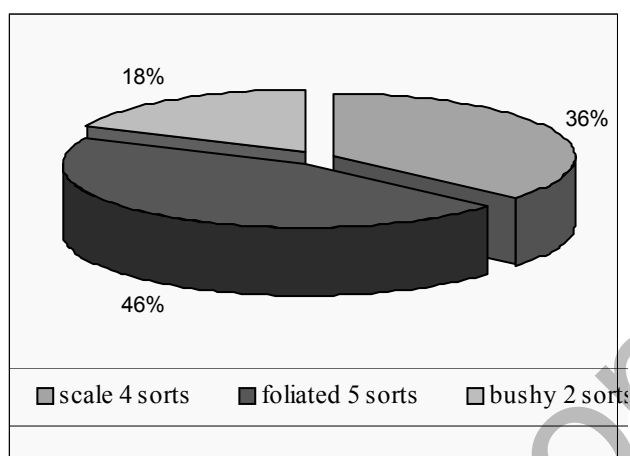
Abundance of lichens on the spreading territory is defined by finding of kind in the unit of volume. Abundance of kind and frequency of occurrence in every point and as a whole one can see in the picture 4.

By external type of thallome structure lichens there are more kinds with scale (4 sorts), foliated (5 sorts), bushy (2 sorts) forms of thallomes.

Morphological groups of lichens by external structure are given in picture — 6. Distribution of lichens into ecological groups depending on substratum of growing one can explore in the picture — 7.

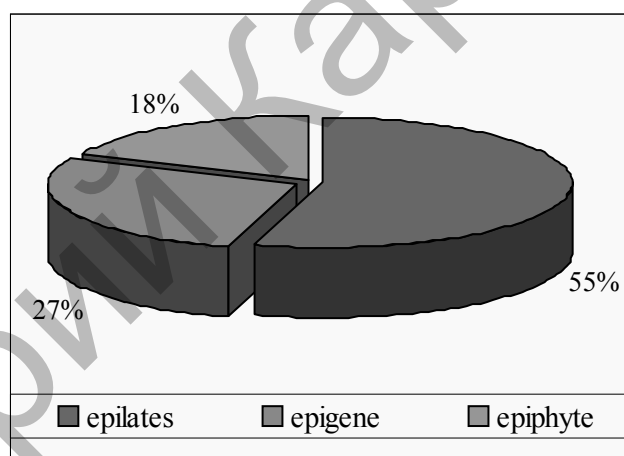
Picture 6

Lichen groups by morphological features



Picture 7

Ecological lichen groups by substratums of growing



By ecological lichen groups epilates lichens (6 sorts) have wide spreading. From them with scale forms of thallomes (3 sorts), foliated (2 sorts) and bushy (1 sort). Mainly all epilates were found in rocks (granites, dolomites etc.) 2 kinds of lichens are applied to epiphyte forms. 3 lichens from 11 dominating kinds are applied to epigene that is soil ecological groups.

For studying lead in lichens they were carefully sorted out, as larger adsorptive ability to hard metal are typical for foliated kinds of lichens, as a result only 1 kind was chosen — *Parmelia vagans* Nyl., which suitable by all parameters and met in all four directions during the whole distance.

Parmelia vagans Nyl is widespread kind of lichens. Typical representative of steppe, desert-steppe communities.

. Epigene lichen *Parmelia vagans* Nyl. was used in biomonitoring of dust emissions of Karagaily ore-dressing and processing enterprise. 8 points of test selections in the radius 500 m — 3 km -9 km from epicenter are founded where thallome of lichen was selected in soils, among vegetation of thinwormwood — fescue — stipa communities and other bushy- forbs- thyme formations in June 2006 and July 2007. Marginal areas of thallomes, partly with soil were used to define lead content. Concentration of lead correlated from the distance to ore-dressing and processing enterprise being the main source of Pb, Mg, Cu and Cd. Pb reached background concentrations beginning with the distance 300 m — from ore-dressing and processing enterprise. Space distribution of Pb coordinated with frequencies of dominant winds therefore the wind of west, north-west directions made main impact [4].

General tendency of lead concentration increasing near opencast mine of ore-dressing and processing enterprise and reduction in Karkaralinsk district remotod from the pollution were found out. More fluctuations in content of Pb were pointed in tests, picked in the wind of west, north directions from ore-dressing and processing enterprise. Pb content I 17.55 times more then in control test and 11.29 times increase PDC

Lead content in *Parmelia vagans* Nyl was defined by atom — absorptive method.

Lead evolving in the process of metallurgical industry during processing polymetal and other ores, burning of coal fuel and exhaust gas of transport fall out on soil surface with the dust, precipitation and accumulating in it can by food chain get into human and animal organism. The definition of gross quantity of lead in soil, water and vegetable material has significant meaning as these data allow to give proper sanitary recommendations.

Lead content in Earth crust in average is 13 mg/kg, in soils — 5 — 25 mg/kg, in vegetable materials — 0- 10 (in average 6.0 mg/kg) mg/kg [5].

LAC of lead in water of basins — 0.1 mg/l, in soil — 20 mg/kg

Principle of definition

Atom — absorptive method of lead defining in soil and vegetable materials was based on mineralization of models in air-locked vessels with the help of nitric acid and measuring of atom absorption of lead under bringing in received solutions into flame.

Quantity of accumulated lead and its concentration in thallomes of *Parmelia vagans* Nyl by main directions of outskirts of Karagaily ore-dressing and processing enterprise are given in the table — 1.

Table 1

Lead content in thallomes of *Parmelia vagans* Nyl.

| № | Direction | Lead content, mg/kg | | | | LAC increasing (6,0 mg/kg) |
|----|-----------|---------------------|-------|-------|---------------|----------------------------|
| | | 3 km | 6 km | 9 km | Average index | |
| 1. | West | 372,24 | 82,02 | 91,92 | 182,06 | 30,34 |
| 2. | North | - | 28,7 | - | 28,7 | 4,78 |
| 3. | East | 39,7 | 33,0 | 19,68 | 30,79 | 5,13 |
| 4. | South | 49,84 | 24,92 | 22,16 | 32,306 | 5,38 |

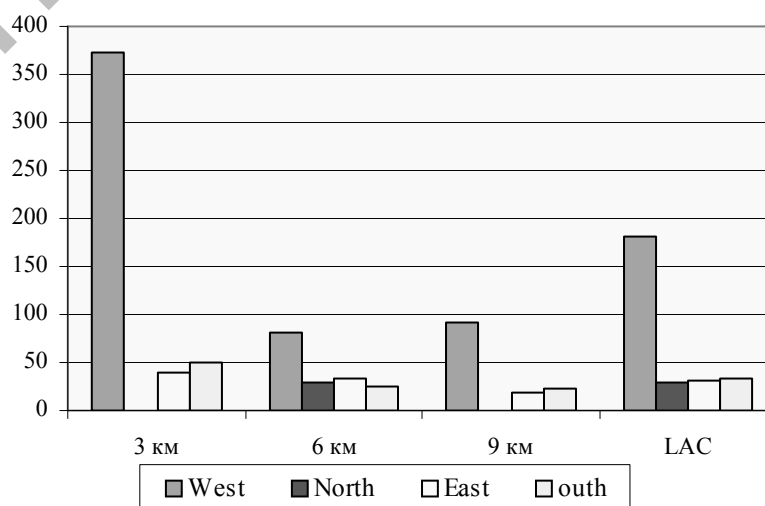
Quantity of accumulated lead and its concentration in thallomes of *Parmelia vagans* Nil from control point that is 61 quarter (2 tests), 20 quarter (2 tests) of Karkaralinsk national natural park are given in the table 2

Table 2

Lead content in thallomes of *Parmelia vagans* Nyl.

| № | Point of selection | 61 quarter | | 20 quarter | | Average index |
|----|---------------------|------------|---------|------------|---------|---------------|
| | | 1- test | 2- test | 1- test | 2- test | |
| 1. | Lead content, mg/kg | 4,39 | 4,86 | 3,07 | 3,28 | 3,9 |

Maximal lead content was pointed in lichen thallomes growing in the west part of researched region (82.02 mg/kg), minimal quantity of lead is in the south part from ore-dressing and processing enterprise (24.92 mg/kg) that can be shown in pictures -1 and 2.

Accumulation of lead in thallomes of *Parmelia vagans* Nyl.

Lichens of Karagaily region differ by number of features including morphological description and it is characterized by different requirements to environment conditions and influences of anthropogenic character factors.

Direction of wind in opencast mine passes above Karagaily. Factory is situated in near foot of hill with the height of 1 km towards the settlement, on the height of 50–60 m in 3 km from this settlement. Air polluted by factory winding through hill passes near the settlement. In the project there is no ventilation tube throwing out polluted air on the hill. Fortunately the rose of winds always directs to north, north-west and west sides. Therefore lead content is mostly in west and north parts of region. If the wind blows towards the settlement the situation will be ecological problem. The least index of lead in north part is explained that in this direction the river with sewage water of factory flows and in the length of large territory there is no life/

The conclusion is that lichens sensitively react to atmospheric air pollution and precipitation of hard metals. Their accumulation in thallomes depends on lichen locality conditions particularly how nearer they are to sources [1].

Conclusions:

By the results of researches following conclusions can be done:

1. 11 widespread kinds of lichens, that applied to 5 orders, 7 families, 9 sorts were found and systematized. Larger part of kinds apply to order LECANORALES (4 kinds). Large kind variety is PARMELIA (3 sorts).
2. By external type of thallomes structure among lichen there are kinds of scale (4 sorts), foliated (5 sorts), bushy (2 sorts) forms of thallomes.
3. By ecological group of lichen epilate lichens (7 sorts) are widespread. Among them with scale form of thallomes (3 sorts), foliated (2–3 sorts) and bushy (1 sort)
4. Concentration of accumulated lead in lichen thallomes in 11, 41 times more then PDC.

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