

Conference Paper

Radioecological Researches in Technogenic Areas of Issyk-Kul Region

Bakyt Kaldybaev¹ and Sultanbek kyzy Chinara²

¹Issykkul state university (IKSU), 103 Abdrakhmanov street Karakol, Kyrgyzstan

²Biology & Pedology institute, 265 Chui Ave, Bishkek, Kyrgyzstan

Abstract

The results of radioecological studies of the assessment of the territory of the Kaji-Sai uranium tailings in the Issyk-Kul region are presented. It is established that the growth of plants in conditions of an increased radiation background leads to a morphological variability of vegetative and generative organs, an increase in the level of chromosomal aberrations.

Keywords: radiation background, tailings, plants, chromosomal aberrations

Corresponding Author:

B. Kaldybaev

k_bakyt@rambler.ru

Received: 17 January 2018

Accepted: 25 March 2018

Published: 17 April 2018

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Selection and Peer-review under the responsibility of the PhysBioSymp17 Conference Committee.

1. Introduction

Long-term finding of plant populations in territories with an elevated natural radiation background can lead to changes in their genetic apparatus and manifest phenotypically as a decrease in their biological productivity, phytopathologies and morphoses of vegetative and generative organs [1, 2]. One of the methods of biodosimetry is the method of cytogenetic analysis. By taking into account chromosome aberrations, attempts are made to evaluate the mutagenic properties of the increased background radiation in areas caused by the occurrence of ore veins near the surface, in the areas of man-made provinces, tailings, dumps containing elevated concentrations of heavy natural radionuclides [3, 4]. Based on the above, the main task of our study was to determine the level of mutagenic background among populations of wild plants in the natural and man - made ecosystems of the Issyk-Kul region.

Technogenic uranium site "Kaji-Sai" is located on the southern shore of Lake Issyk-Kul. Mining Plant Mini USSR Ministry of Medium Machine Building for processing uranium ore-centered functioning from 1948 to 1969, it was subsequently converted into electrical engineering plant. Coal is mined in the local underground mine, previously burned a passing generation of electricity, after which the uranium oxide was removed by acid leaching of the ash. Wastes from the manufacture and industrial equipment

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had been buried, forming a radioactive dump, with a total volume of the uranium-400 thousand m³ of moves. Exposure dose of radiation background in the field of uranium waste disposal is 200 - 300 mcR/h, and the individual destruction of the protective layer of radioactive dump to 1300 mcR/h [5].

2. Materials and methods

The seeds of wild plants were chosen as objects of research: Harmanas harmala (Peganum harmala), Dandelion (Traxacum sp.), Plantago maritime (Plantago lanceolata) growing in the territory of the Issyk-Kul region. When carrying out the chromosome analysis, a technique was used to prepare temporary pressures from meristematic root zones. Chromosomal mutations were taken into account by the ana-telophase method according to the recommendations set forth in the methodical works [6]. Statistical processing of the results was carried out by the method of variational statistics [7]. Ana-telophase plates were analyzed with a Leica DM LB 2 light-optical microscope with Bio Vision 4.0 software and a Leica DFC 320 photocatalyst.

3. Results

The results of cytogenetic studies presented in the table 1, that the average level of mutability of populations of wild plants in the Issyk-Kul region is 2,2%, the frequency of chromosomal aberrations varied between 1,6 and 4,2%. A total of 7,500 cells were scanned, 163 chromosomal aberrations were detected, 45,4% of which were single fragments, 28,8% of chromatid bridges, 6,1% of paired fragments, 12,3% of chromosome bridges, 7,4% of seven chromosome lagging.

TABLE 1: The level of chromosomal aberrations in cells of wild plants of the Issyk-Kul region.

| Place of selection | Plant species | Number of scanned cells | Total violations | Cells with disorders |
|--------------------|-----------------|-------------------------|------------------|----------------------|
| light brown soils | Traxacum sp. | 500 | 10 | 2,0±0,62 |
| light brown soils | Peganum harmala | 500 | 8 | 1,6±0,56 |
| tailings Kaji-Say | Traxacum sp. | 500 | 21 | 4,2±0,89 |
| tailings Kaji-Say | Peganum harmala | 500 | 17 | 3,4±0,81 |

In the spectrum of chromosome disturbances, chromatid type aberrations predominate—single fragments, chromatid bridges, as shown in fig. 1. A small percentage of chromosome type aberrations are paired fragments and chromosome bridges, probably this is due to the effect of a low-dose radiation factor on the genetic apparatus of wild plants in the Issyk-Kul region.

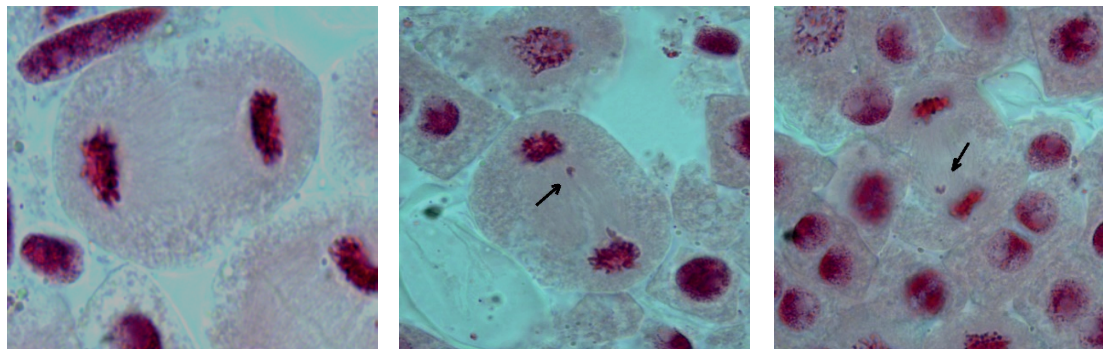


Figure 1: Ana-telophase plate *Peganum harmala* with chromosomal disorders.

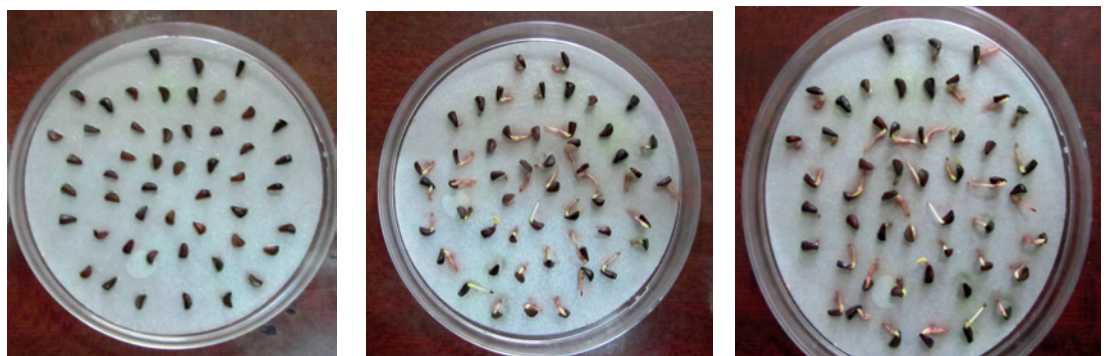


Figure 2: Germination of seeds of *Peganum harmala*.



Figure 3: In place of flowers *Peganum harmala*, 5 petals marked 6.7 petals, the sterility of flowers *Peganum harmala*.

4. Discussion

A comparative analysis of the results of the cytogenetic study of wild plant populations in the Issyk-Kul region showed that the highest frequency of chromosomal aberrations is typical for the *Peganum harmala* from the tailings site of the technogenic uranium province of Kaji-Sai - 3.4% and *Traxacum sp.* - 4.2 %. In addition, in the root meristems of these plant populations, there is a decrease in the mitotic activity of cell division and the percentage of seed embryo. The germination of *Peganum harmala* seeds is shown in fig. 2.

The growth of plants in a medium with a high concentration of uranium is accompanied by the morphological variability of vegetative and generative organs. So the population of the *Peganum harmala* of the ordinary growing on the terrigenous tailings Kadji-Sai forms flowers with six or nine sepals, instead of the usual five, a decrease in the number of generative shoots, increasing infertility of flowers. Morphological abnormalities of plants are shown in fig. 3.

5. Conclusion

These observations show that the growth of herbaceous plants on the territories contaminated with uranium waste leaves its imprint on their appearance: slow growth, poverty, monotony of the flora. The effect of the radiation factor, may be the cause of increased mutational variability of plants.

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