

ABSTRACT

dissertation for the degree of Doctor of Philosophy (PhD) in the speciality
"8D05108 - Geobotany"

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**«Comprehensive research of the family Chenopodiaceae Vent.
(Amaranthaceae Juss.) flora of the desert part of the Syrdarya river valley»**

General characterisation of the work. The work is devoted to the study of taxonomic composition, peculiarities of ecological and phytocenotic assignment, anatomy of assimilatory organs and phylogeny of species of the family Chenopodiaceae (Amaranthaceae s.l.) of the flora of the desert part of the Syrdarya river valley.

Relevance of the research topic. In desert regions, human life is confined to water sources. Therefore, it is in the river valleys, in particular in the Syrdarya river valley, there is a significant anthropogenic impact characterised by historical duration and a high degree of stress on vegetation. It should be taken into account the dynamism and vulnerability of the valley vegetation, represented by various types, including desert automorphic communities due to the significant width of the Syrdarya river valley.

Long-term human impact on the environment and exploitation of natural resources have caused a significant change in the vegetation cover of the Earth. Now there are almost no ecosystems and plant communities that have not experienced anthropogenic influences, which, first of all, led to a decrease in the species richness of phytocenoses and species diversity of flora as a whole. And preservation of the global ecosystem of the planet is impossible without preservation of taxonomic diversity of its components.

Under the impact of various factors of human activity on the environment, especially in areas located in the desert zone, the most vulnerable are the flora and vegetation of river floodplains, terraces, coastal strip. The negative impact is expressed in a significant change of primordial biocenoses, reduction of numbers and ranges of fodder and other useful species.

The family Chenopodiaceae belongs to the largest and oldest families of arid territories of the globe. It occupies a leading position in the spectrum of families of desert floras of Kazakhstan. A number of representatives of the family, being dominants and edifiers of many desert communities, play an important role in the composition of the vegetation cover.

The choice of the study region - the desert part of the Syrdarya River valley within the Kyzylorda region, Republic of Kazakhstan - is conditioned by the wide distribution of saline territories within its limits, to which the overwhelming majority of species of the studied family are confined. They are widely represented in various desert ecotopes, including clay and sandy deserts, where they form various phytocenoses, associations and formations.

Chenopodiaceae is a very systematically complex group. Most of its representatives are late-flowering and accordingly late-fruited succulents. Due to their external uniformity, it is very difficult to define the representatives of this

family. Besides, they possess considerable polymorphism and strong age variability. In addition, the family is diverse in ecomorphological characteristics, anatomical types, and photosynthesis modes. The increased interest of systematists in this peculiar group is connected with the discovery of two anatomical types of photosynthesis. Many genera remain insufficiently studied even nowadays.

Objects of the study: The objects of the study are species of the family Chenopodiaceae (Amaranthaceae s.l.), growing in the desert part of the Syrdarya river valley within Kyzylorda region.

Subject of the study: The subject of the study is the identification of species composition of the family Chenopodiaceae (Amaranthaceae s.l.) of the flora of the desert part of the Syrdarya river valley, ecological-geographical and phytocenotic features, anatomical and molecular-genetic structure of its representatives.

Purpose of work: Study of taxonomic composition, peculiarities of ecological and phytocenotic assignment, salt tolerance, anatomical structure, phylogeny of species of Chenopodiaceae (Amaranthaceae s.l.) family of the flora of the desert part of the Syrdarya river valley.

Objectives of the study:

1 Identification of taxonomic composition of Chenopodiaceae families of the desert part of the Syrdarya river valley;

2 Study of ecotopic habitat, phytocenotic role of Chenopodiaceae species of the desert part of the Syrdarya river valley and anthropophilic representatives of the family;

3 Identification of peculiarities of edaphic habitat and salt tolerance of Chenopodiaceae species;

4 Study of anatomical structure of assimilation organs of dominant species of Chenopodiaceae;

5 Study of phylogeny issues, identification of genome size and ploidy of dominant species of Chenopodiaceae in the flora of the Syrdarya river valley.

Scientific novelty of the study.

For the first time in Kazakhstan the complex study of species of Chenopodiaceae family of flora of Syrdarya valley was carried out.

16 geographical novelties for Kyzylorda region are given.

Phytocenotic peculiarities of Chenopodiaceae species in the formation of vegetation cover were revealed.

Edaphic preferences of Chenopodiaceae species to different types of salts and degree of salinisation were determined for the first time.

The genome sizes of representatives of Chenopodiaceae family were determined for the first time: *Halostachys belangeriana*, *Salicornia europaea*, *Xylosalsola arbuscula*, *Anabasis aphylla*, *Climacoptera obtusifolia*, *Petrosimonia sibirica*, *Caroxylon orientale*, *Suaeda microphylla*, *S. linifolia*, *Suaeda altissima*.

A phylogenetic tree of the time of origin of subfamilies, tribes and genera was compiled.

Theoretical significance of the work.

The modern composition of representatives of the family Chenopodiaceae of the desert part of the Syrdarya river valley has been revealed, including 112 species, 16 of which are geographical novelties for this region.

It is shown that in spite of the leading position in the flora of the study area of the representatives of Chenopodiaceae, the number of anthropophilic elements in its composition in comparison with other large systematic groups is insignificant.

The range of salt tolerance and edaphic preferences of dominant and characteristic for its vegetation species of Chenopodiaceae family was determined within the study area.

8 types of anatomical structure of assimilation organs were revealed in dominant and characteristic for the Syrdarya river valley vegetation representatives of Chenopodiaceae family.

The greatest adaptability to arid habitat conditions was revealed in polyploid populations of *Kalidium capsicum*.

Practical value of the study.

The compiled prospectus of species of Chenopodiaceae family of the flora of the desert part of the Syrdarya valley can be used in educational processes in the study of local and regional floras.

The obtained results of geobotanical studies can be used for further monitoring works to identify trends in the development of anthropogenic processes in saline areas of Kyzylorda region.

On the basis of 4 groups of salinity degrees, the dominance of specific species of Chenopodiaceae family in saline areas allows to visually determine the level of soil salinisation.

Herbarium sheets of species of the studied family and related species were collected, prepared and transferred to the Herbarium Fund of the Institute of Botany and Phytointroduction (AA) - 267 herbarium sheets (Appendix A). Seed materials of species of the studied family were collected and transferred to the Seed Bank of the Institute of Botany and Phytointroduction - 15 species (27 specimens) (Appendix B).

The main provisions for defence:

Modern species composition of Chenopodiaceae family of flora of desert part of Syrdarya river valley was specified;

According to the degree of soil salinity the studied species of Chenopodiaceae family are distributed into 4 groups;

For the studied strongly and very strongly saline territories, the most characteristic communities of *Kalidietum*, *Halocnemetum*, *Halostachetum* and *Suaedetum* were identified, in which the share of Chenopodiaceae species is 80-100%;

Among the dominant and frequently occurring species of the Chenopodiaceae family of the study area, 8 characteristic types of anatomical structure were identified;

New data on genome size and presumed ploidy were obtained. The possible time of origin of subfamilies, tribes and genera of dominant species of the Chenopodiaceae family of the flora of the desert part of the Syrdarya river valley was determined.

Personal contribution of the author. The author personally determined the species composition of the family Chenopodiaceae of the flora of the desert part of the Syrdarya river valley. Chenopodiaceae flora of the desert part of the Syrdarya river valley. Phytocenoses with participation and dominance of species of the family Chenopodiaceae were analysed. Chenopodiaceae. Soil samples were collected in the study area. Molecular-genetic analyses in laboratory conditions. Writing of the articles was carried out with co-authors, with the author's personal contribution being the main one.

Relation to the plan of the main scientific works. The dissertation work was carried out within the framework of the project AP09258929 "Prospects for the use of correlation between the composition of anthropophilic element of the flora of the desert part of the Syrdarya river valley and the type of land disturbance for predictive purposes" (2021-2023). Also, additional data were obtained for the following projects: AP05131957 "Monitoring studies of restoration of natural vegetation in abandoned rice fields of the Kyzylorda region, prospects for their use" (2018-2020), AP08956492 "Relict turangovniki of the Syrdarya river valley (species composition, anthropogenic impact, conservation issues)" (2020-2021), AP08856696 "Ethnographic and geoarchaeological study of agricultural and pastoral landscapes in the desert deltas of Kazakhstan: historical phases of development and desolation" (2020-2022), AP14869593 "Study of genetic diversity and phytochemical analysis of species of the genus *Salsola* L. Kazakhstan" (2022-2024).

Approbation of the work. Materials of the dissertation work were reported and discussed:

- at the XIX International Scientific and Practical conference "Problems of botany of South Siberia and Mongolia". Barnaul, Russia, 2020;
- at the XX International Scientific and Practical Conference "Problems of Botany of Southern Siberia and Mongolia". Barnaul, Russia, 2021;
- VIII International Scientific Conference of Students and Young Scientists "Farabi Əlemi", Al-Farabi KazNU, Almaty, Kazakhstan, 2021;
- at the International Scientific and Practical Conference "Problems and Prospects of Studying Vegetation Biodiversity in Central Asia". Tashkent, Uzbekistan, 2022;
- at the International Scientific and Practical Conference "Study, conservation and rational use of flora of Eurasia". Almaty, Kazakhstan, 2022;
- at the International Scientific and Practical Conference "Introduction, conservation of biodiversity and green building in the conditions of changing climate and anthropogenic impact". Aktau, Kazakhstan, 2022;
- at XXII International Scientific and Practical Conference "Problems of Botany of Southern Siberia and Mongolia". Barnaul, Russia, 2023.

Publications. The main content of the thesis is reflected in 20 printed works, including 4 articles in an international peer-reviewed journal with impact factor, cited in Scopus and Web of Science; 5 articles from the list of editions recommended by the Committee for Quality Assurance in Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan for the publication of the main

results of scientific activity, 11 articles and abstracts in the proceedings of international and national conferences, of which 5 foreign.

Dissertation structure. The thesis is set out on 136 pages and consists of a list of notations and abbreviations, introduction, literature review, materials and methods, results and discussion, conclusion and list of used sources of 243 names; it contains 8 tables, 49 figures and 8 appendices.