



Theme 1 Status and trends of global soil nutrient budget



ASSESSMENT OF THE DIVERSITY OF CULTURABLE MICROORGANISMS IN ARAL SEA SOIL SAMPLES IN THE AUTUMN-WINTER PERIOD

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INTRODUCTION

A common feature of the Aral Sea region soils is their high salinity, extreme instability of the moisture level, and up to complete drying, leading to the accumulation of many salts in the upper horizons and the inability to use such lands for the cultivation. The presence of microorganisms in degraded soils, the rhizosphere, and the tissues of native plants makes it possible to assess the potential and predict the development of saline territories.

We have studied 15 soil and halophyte plant rhizosphere samples from the Aral Sea coast, the Ustyurt Plateau, and the Barsa Kelmes saline November-December 2021 (fig.1).

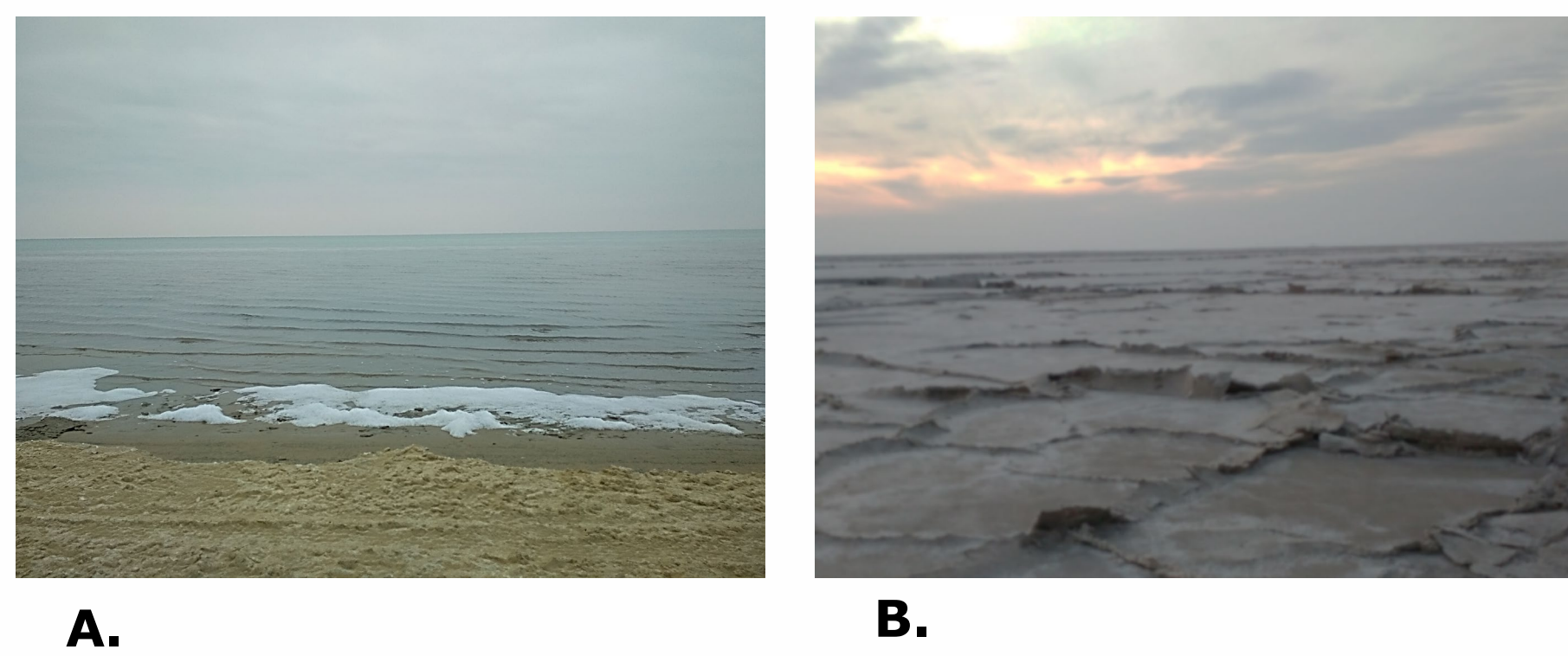


Fig. 1. Sampling locations:
A. Aral Sea coast and B. Barsa Kelmes saline

METHODOLOGY

The chemical composition of the soil was determined in accordance with the approved state standards. Microbial isolation was carried out on Czapek–Dox media (for fungi) and NB/NA (for bacteria) media supplemented with 5–15% NaCl. Microorganisms were identified by examining conidia according to the Litvinov Microscopic Soil Fungi Guide (for fungi) and according to MALDI-TOF MS (for bacteria).

RESULTS

The chemical analysis of soil samples showed that the humus content ranges from 0.359% to 4.368%, the water extract of soils has the pH value of 8.23 in the Barsa Kelmes saline area 9.27 at the Aral Sea coast. The concentration of salts in the samples from the Aral Sea coast ranged from 4.718 g/l to 14.957 g/l; the most saline representatives were registered near the Barsa Kelmes saline from 10.988 g/l to 56.628 g/l, while in the rhizosphere of halophytes a low salt content was observed, amounting to 0.243 g/l - 0.757 g/l (fig.2).

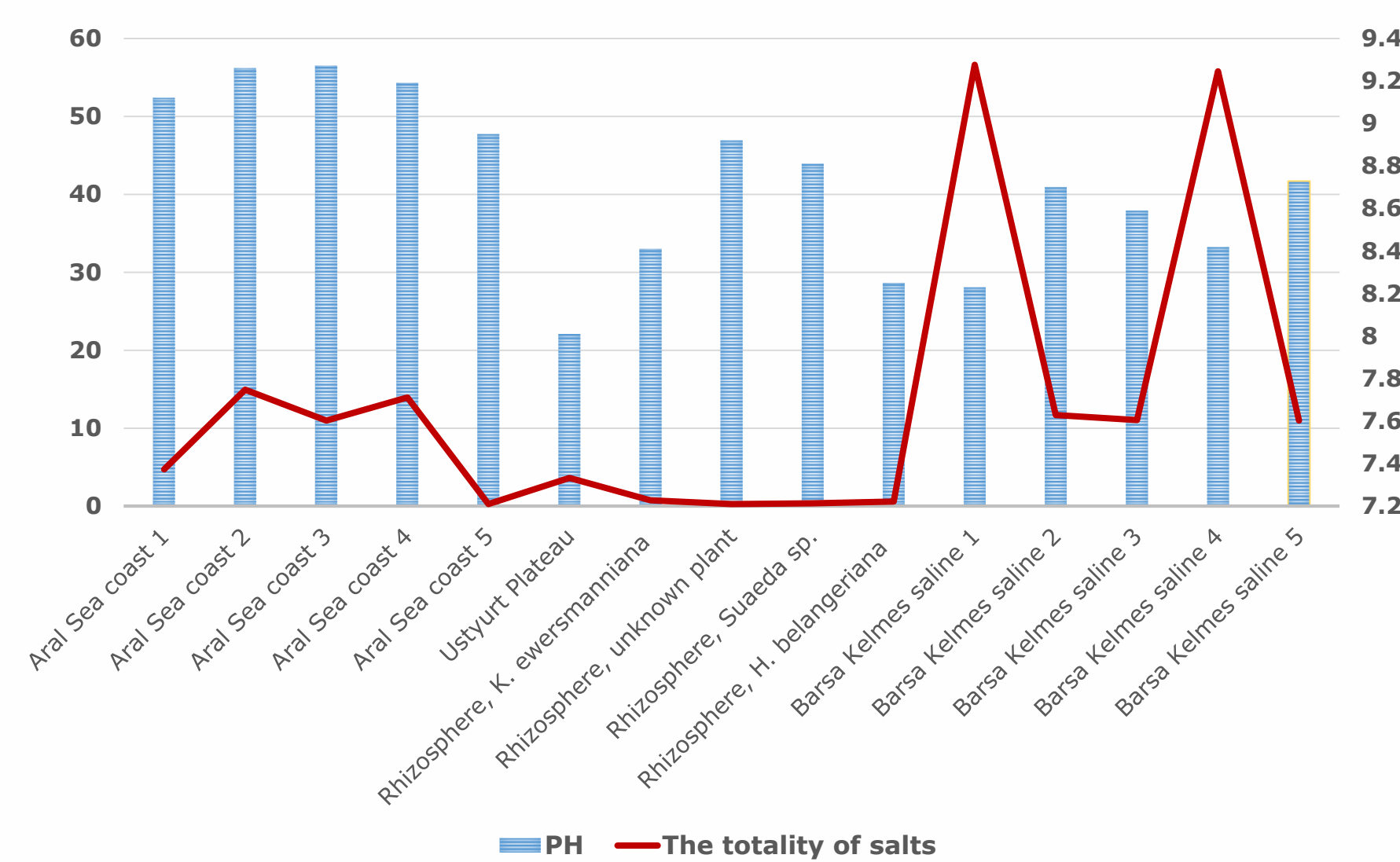


Fig. 2. pH level and salinity of the Aral Sea samples

As a result of isolation and study of the diversity of microorganisms, 38 fungal and 14 bacterial isolates characterized by halotolerance were isolated into a pure culture, including 18 isolates of soil fungi and 20 isolates of endophytic fungi, six isolates of soil bacteria, and eight isolates of endophytic bacteria.

It was established (fig.3) that the most significant number of halotolerant cultures was isolated from the rhizosphere and tissues of the halophyte *Krascheninnikovia ewersmanniana*, the least - from the coastal soil of the Aral Sea, and from 6 samples of the coastal zone of the Aral Sea and Barsa Kelmes it was not possible to obtain a single culturable form of microorganisms.

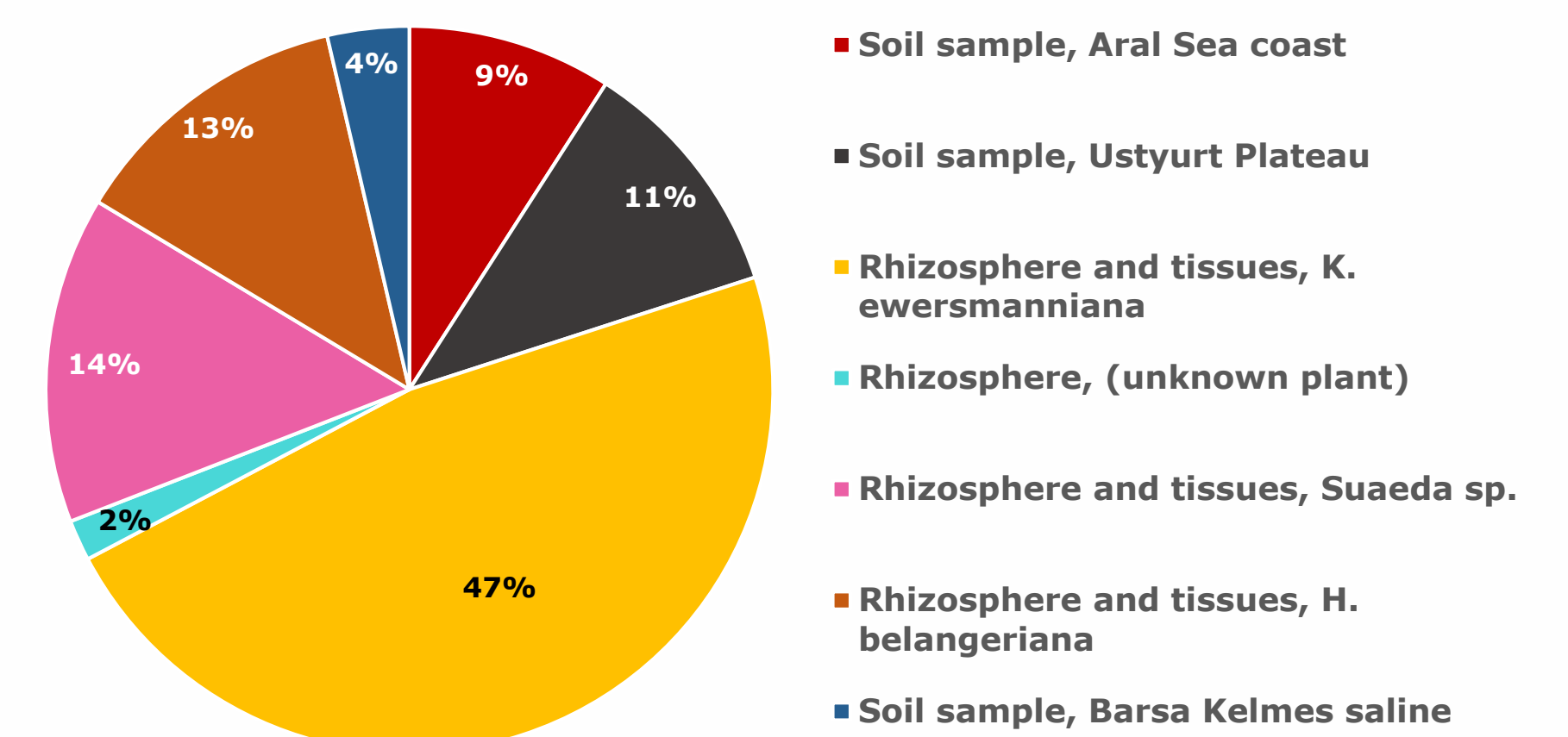


Fig. 3. Isolation of halotolerant microorganisms from samples of the Aral Sea region

Aspergillus, *Alternaria*, *Penicillium* represent the isolated fungal isolates, and one isolate was *Mycelia sterilia*. Bacteria are represented by *Bacillus*, *Staphylococcus*, *Azoarcus*, *Ochrobactrum*, *Pseudomonas*, *Halomonas*, *Oceanobacillus* and *Lactobacillus*, two isolates that could not be identified by MALDI-TOF-MS.

CONCLUSIONS

As a result of studying the microbial communities of soil samples and halophyte plants of the Aral Sea region, it was established that the number of microorganisms and their diversity is small in the autumn-winter period. The presence of identified groups of microorganisms that can exist in such harsh conditions indicates their great adaptability and specificity, and opens up prospects for their further use in remediation programs.

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