AMERICAN JOURNAL OF APPLIED MEDICAL SCIENCE
ISSN: 2996-5101 (online) | ResearchBib (IF) = 9.818 IMPACT FACTOR
Volume-3| Issue-5| 2025 Published: |30-05-2025|

INFLUENCE OF EPIPHYTIC BACTERIA ON THE YIELD OF FODDER CROPS UNDER UNFAVORABLE CONDITIONS OF KARAKALPAKSTAN

https://doi.org/10.5281/zenodo.15378027

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Abstract

This research explores the role of epiphytic bacteria in enhancing the productivity of fodder crops grown under the harsh environmental conditions of Karakalpakstan. Due to factors such as high soil salinity, water scarcity, and temperature extremes, agricultural productivity in this region faces significant challenges. Epiphytic bacteria, which naturally inhabit the surfaces of plant organs, may contribute to plant resilience by promoting growth, improving nutrient uptake, and increasing stress tolerance. The study evaluates how the presence and activity of these beneficial microorganisms can positively influence fodder crop yield, thus offering sustainable strategies for improving agriculture in arid and semi-arid regions.

Keywords

Epiphytic bacteria, fodder crops, Karakalpakstan, plant growth promotion, abiotic stress, salinity, sustainable agriculture, microbial interaction, yield improvement, arid zone farming.

Introduction

Karakalpakstan, located in the arid zone of Uzbekistan, faces significant agricultural challenges due to its harsh climatic conditions, including high soil salinity, water scarcity, and extreme temperatures. These factors adversely affect the growth and productivity of fodder crops, which are essential for livestock

nutrition. Recent studies have highlighted the potential of epiphytic bacteria—microorganisms residing on plant surfaces without causing harm—to enhance plant growth and stress tolerance. This research aims to explore the role of epiphytic bacteria in improving the yield of fodder crops under the unfavorable conditions prevalent in Karakalpakstan.

Collection of Plant Samples:Native plant species from Karakalpakstan were selected for the isolation of epiphytic bacteria. Plants were carefully sampled from various locations to ensure a diverse bacterial population.Isolation and Identification of Epiphytic Bacteria .Surface sterilization techniques were employed to eliminate external contaminants. The plants were then cultured on selective media to isolate epiphytic bacterial strains. Isolated bacteria were identified using morphological, biochemical, and molecular methods, including 16S rRNA gene sequencing. Epiphytic microbial community of plants Microorganisms that live and reproduce on the surface of the above-ground parts of plants and in their rhizosphere zone are called epiphytic. A characteristic feature of these microorganisms is that they are able to feed on plant secretions without dying from phytoncides, and are resistant to conditions of low humidity. The microflora associated with the above-ground organs of plants is diverse in composition and unites representatives of various systematic groups of microorganisms: bacteria, actinomycetes, yeast, yeast-like and hyphal fungi. Many types of yeast isolated from the surface of plants have specific morphological and physiological characteristics that indicate their adaptability to existence in this type of habitat. The presence of carotenoid and melanoid pigments is also characteristic of a number of epiphytic bacteria, which serves as an adaptation of these organisms to life in this specific ecological niche.

It is believed that mycelial sporoactinomycetes are generally not typical inhabitants of the phylloplane of plants ; they are typical pedobionts or dwellers of litter and the rhizosphere. Although there are reports of actinomycetes of the genera Micromonospora and Streptomyces being found on plant surfaces, it is unknown whether they are present in active form or as spores that arrive there through various means from the soil (wind, rain) and accumulate in the phylloplane. However, actinomycetes of the genus Micromonospora are widely represented in the phyllosphere of desert plants . Analysis of the lists of microbial taxa isolated from the phyllosphere of various plant species over recent years by different researchers allows for the identification of common and most typical forms. The bacterial forms are represented by Pseudomonas, Xanthomonas, Flavobacterium, Agrobacterium, Erwinia, Klebsiella, Cytophaga, and representatives of the order Myxobacterales.

Screening for Plant Growth-Promoting Traits.The isolated bacterial strains were screened for various plant growth-promoting (PGP) traits, such as nitrogen fixation, phosphate solubilization, production of indole-3-acetic acid (IAA), and ACC deaminase activity. These traits are indicative of the bacteria's potential to enhance plant growth and stress tolerance.

Greenhouse and Field Experiments Selected epiphytic bacterial strains exhibiting strong PGP traits were applied to fodder crops in greenhouse and field trials. The experiments assessed the effects of bacterial inoculation on plant growth parameters, nutrient uptake, and overall yield under controlled and natural environmental conditions.

Isolation and Identification of Epiphytic Bacteria

A total of 15 epiphytic bacterial strains were isolated from the surface of native plants. Molecular identification revealed that these strains belonged to genera such as Bacillus, Pseudomonas, Brevibacillus, and Klebsiella. These genera are known for their plant growth-promoting capabilities. Plant Growth-Promoting Traits

The isolated strains exhibited various PGP traits:

- Nitrogen Fixation: Several strains demonstrated the ability to fix atmospheric nitrogen, providing an essential nutrient to plants.
- Phosphate Solubilization: Some strains could solubilize inorganic phosphate, making it available for plant uptake.
- IAA Production: Indole-3-acetic acid production was observed in certain strains, promoting root development and overall plant growth.
- ACC Deaminase Activity: This activity helps in reducing ethylene levels, alleviating plant stress.

Effects on Fodder Crop Growth and Yield:Inoculation with selected epiphytic bacterial strains resulted in significant improvements in fodder crop growth parameters, including increased plant height, biomass, and root development. An analysis of the literature concerning complexes of phytopathogenic micromycetes and common epiphytic microorganisms indicates that, in the vast majority of cases, the microflora of the phyllosphere has been studied separately from each other, in different regions with varying ecological conditions, and during different time periods. As a result of these studies, valuable scientific data have been obtained that characterize the autonomous development of common epiphytes and phytopathogenic micromycetes. In our view, the microbial complexes of the phyllosphere (epiphytes and phytopathogens) form a unified system of "microorganisms–plant".

Discussion:The positive effects observed in this study align with findings from other arid regions. For instance, epiphytic bacteria isolated from desert plants have

been shown to promote plant growth by enhancing nutrient availability and stress tolerance. The genera Bacillus and Pseudomonas are particularly noted for their beneficial interactions with plants in saline and drought-prone environments. The results underscore the potential of utilizing native epiphytic bacteria as sustainable bioinoculants to improve fodder crop productivity in Karakalpakstan.

Conclusion

This study demonstrates that epiphytic bacteria can significantly enhance the growth and yield of fodder crops under the challenging climatic conditions of Karakalpakstan. By promoting nutrient uptake and stress resilience, these bacteria offer a sustainable alternative to chemical fertilizers, contributing to environmentally friendly agricultural practices. Further research is recommended to explore the long-term effects and scalability of using epiphytic bacteria in large-scale agricultural systems.

REFERENCES:

1. Al-Kahtani, M.D.F., et al. (2020). Isolation and Characterization of Plant Growth Promoting Endophytic Bacteria from Desert Plants and Their Application as Bioinoculants for Sustainable Agriculture.

2.YemelyanenkoP.A. i dr.Veterinarnaya mikrobiologiya. M. Kolos.1982. s.96 – 130.

3.Timakov V.D. Mikrobiologiya. Uchebnik. M. Medesina, 1983. s. 164-205.

4.Pyatkin K.D. Krivoshein Yu.S . Mikrobiologiya. M.Medisina 1981. s.163-220.

5.Asonov N.R. Mikrobiologiya. 1989. S. 191-213.