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Abstract

Microbes in Saline Environments and Their Potential Applications in Sustainable Agriculture †

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Abstract: This review paper aims to summarize aspects related to the biotechnological potential of halophile and halotolerant microbes in the sustainable management of agricultural practices. During the past few years, different microorganisms have been isolated from saline environments (including in Romania) and characterized for the discovery of new species and their potential use in industrial applications. This paper presents a brief literature review, conducted using various open access scientific databases using keywords such as halophilic bacteria/bioinoculants, saline soils, halotolerant ecology, novel halophiles, plant growth-promoting halophiles, salinity stress, salt-tolerant microbes, etc.

Keywords: halophiles; halotolerant; microorganisms; sustainable agriculture; saline environments

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Presently, 33% of global arable land (952.2 million ha) is affected by salinity and the estimated annual growth rate of salt stress-affected soils is estimated to be 7% (50% of agricultural areas will be affected by 2050). Saline soils in Europe represent 17.30%, though little is known about the biodiversity and ecology of halophilic microorganisms and their effects on agricultural processes [1,2]. In recent decades, the scientific community has been focusing more attention on saline and hypersaline environments, due to these unique ecosystems being new sources of microbial species that are capable of synthesizing biotechnological products (i.e., hydrolytic enzymes or polymers with industrial-, agricultural-, and environmental-protection applications). Saline stress affects agricultural production, but alternative methods to sustainably manage saline and sodium soils, such as those involving the use of halophilic and halotolerant microorganisms, could be successfully applied [3,4].

Some of the most frequently isolated microorganisms from saline environments in Romania (saline lakes—Techirghiol, Telega, Ursu, Balta Albă, Amara, Movila Miresei, Baia Roșie, and Baia Verde) belong to the genera *Haloarcula*, *Haloferax*, *Halorubrum*, *Halobacterium*, and *Halomonas*; order *Actinomycetales* (*Rhodococcus ovatensis*), *Euryarchaeota*, genus *Idiomarina*, *Salinibacter* sp., and *Bacillus* sp. All of these have the ability to synthesize extremozymes (amylase, lipase, cellulase, pectinase, caseinase, gelatinase, inulinase), polyhydroxybutyrate (PHB), carotenoid pigments, melanin, or other bioproducts with applications in phytoremediation/bioremediation or plant growth stimulation (phytohormones—indoleacetic acids, gibberellic acids, and cytokines; siderophores; biocontrol agents, biofertilizers, and biostimulators), contributing to solubilization and absorption of nutrients by plants (phosphorus, potassium, zinc) and/or triggering plant-protection mechanisms against phytopathogens [2–5].

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