Prospection of Bioactive Compounds Produced by Bacterial Isolates from Caves: Antioxidant and Antibacterial Activities

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Introduction

Caves, natural geological formations resulting from rock cavities with adverse abiotic conditions, are considered extreme and inhospitable habitats. This further emphasizes the remarkable adaptability of microorganisms that manage to inhabit them. These unique environmental characteristics enable microorganisms to develop specific metabolisms and produce new bioactive compounds with potential activities, such as antimicrobial and antioxidant properties [1]. This research aims to evaluate the antioxidant and antibacterial activity against Gram-negative and Gram-positive of diluted lyophilised extracts produced by strains isolated from pristine environments such as 3 caves on Selvagem Grande Island (Madeira archipelago, Portugal), 2 caves on Lanzarote Island (Canary archipelago, Spain) and the Paleolithic Escoural Cave (Montemor-o-Novo, Portugal [2]). The results obtained suggest that the selected bacterial isolates produce biologically active compounds that have the potential to serve as viable alternatives to conventional antibiotics or as antioxidants. These findings have wide-ranging implications for health and well-being, covering areas such as nutrition, pharmacology, cosmetics, and even the culinary sector.

Methodology


Sampling


Bacterial culture

Obtention of free cells culture broths

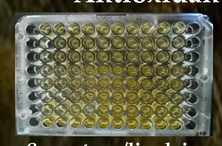
Biological activities assessment

Antibacterial activity

growth inhibition assessment


agar well-diffusion method

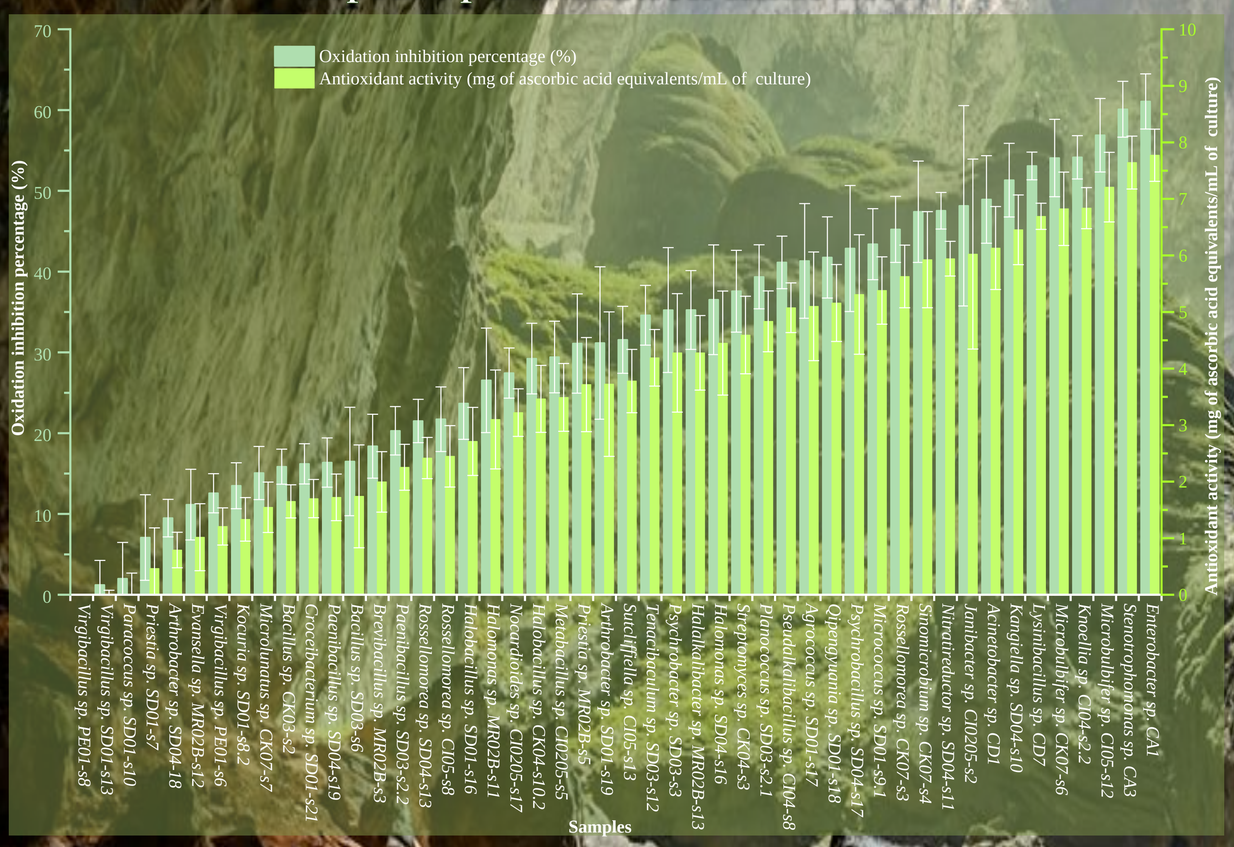
Antioxidant activity


β-carotene/linoleic acid method

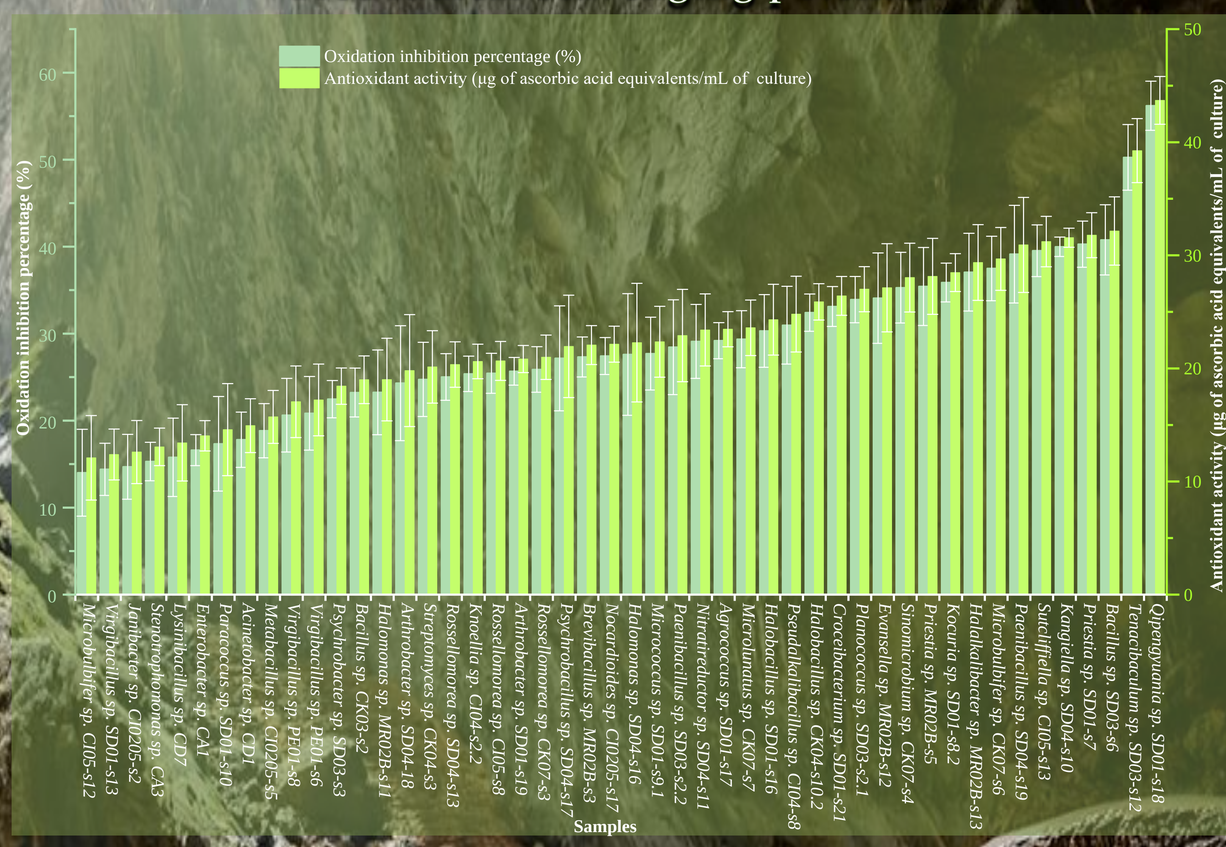

DPPH method

Results

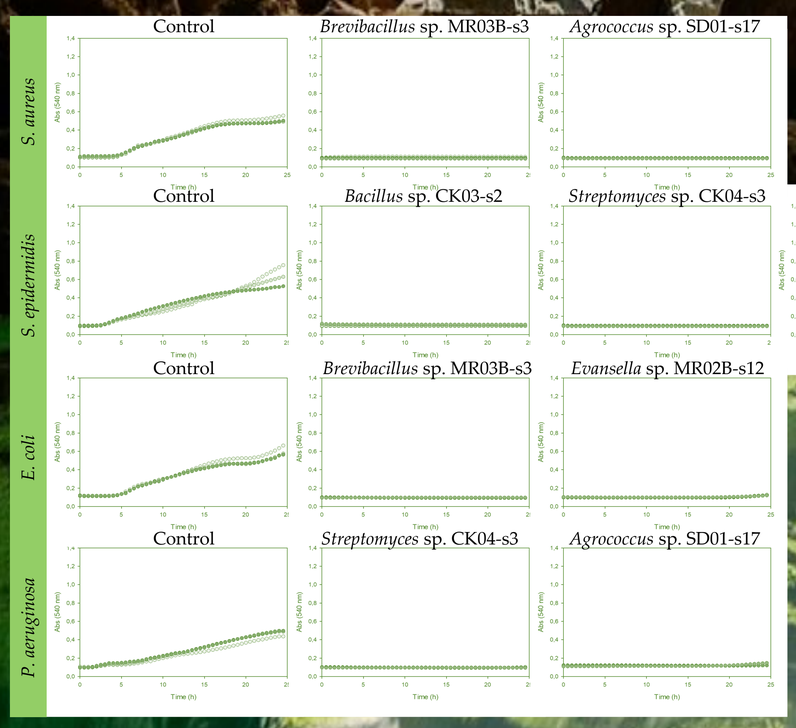
Lipidic peroxidation inhibition



Free radical scavenging potential



Antibacterial activity in liquid media



Antibacterial activity by paper disc diffusion method

Samples	Pathogenic bacteria and Bacterial inhibition zones (mm)			
	S. aureus	*S. epidermidis*	*E. coli*	*P. aeruginosa*
***Brevibacillus* sp. MR02B-s3**	6.50±0.50	n.d.	7.60±1.53	8.35±0.22
***Evansella* sp. MR02B-s12**	n.d.	n.d.	7.10±1.05	n.d.
***Bacillus* sp. CK03-s2**	n.d.	12.17±2.72	n.d.	n.d.
***Streptomyces* sp. CK04-s3**	n.d.	8.03±1.95	n.d.	n.d.
***Janibacter* sp. CI0205-s2**	n.d.	7.60±2.08	n.d.	n.d.
***Agrococcus* sp. SD01-s17**	11.00±1.32	n.d.	n.d.	10.83±0.29

Mean values from 3 disks ± SD are demonstrated, n.d. – not determined.

A - *Agrococcus* sp. SD01-s17 against *S. aureus*
B - *Agrococcus* sp. SD01-s17 against *P. aeruginosa*

Remarks

- The extracts of the isolates *Enterobacter* sp. 1, *Stenotrophomonas* sp. CA3, *Microbulbifer* sp. CI05-s12, *Knoellia* sp. CI04-s2.2, *Microbulbifer* sp. CK07-s6, *Lysinibacillus* sp. CD7, *Kangiella* sp. SD04-s10, *Qipengyuania* sp. SD01-s18 *and Tenacibaculum* sp. SD03-s12 showed an antioxidant activity greater than 50% inhibition.
- In the future, it would be interesting to carry out a dose-response tests for antioxidante activity.
- Some extracts showed a high inhibition of the growth of pathogenic bacteria, with prominence in *Brevibacillus* sp. MR02B-s3, which showed activity against *Staphylococcus epidermidis, Staphylococcus aureus* and *Escherichia coli* and *Agrococcus* sp. SD01-s17 extract which inhibited the growth of *Staphylococcus epidermidis* and *Staphylococcus aureus* during the 24h assay.

References:
[1] P. Gatinho, C. Salvador, A.M. Silva, A.T. Caldeira, Prokaryotic Communities from Pristine Cave Environments : Biotechnological Potential with Sustainable Production, (2023) 1–22. https://doi.org/10.3390/su15097471.
[2] A.T. Caldeira, N. Schiavon, G. Mauran, C. Salvador, T. Rosado, J. Mirão, A. Candeias, On the biodiversity and biodeteriogenic activity of microbial communities present in the hypogenic environment of the Escoural Cave, Alentejo, Portugal, Coatings. 11 (2021) 1–17. https://doi.org/10.3390/coatings11020209.

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