The biotechnological potential of marine-derived *Penicillium* strains isolated from the Portuguese coast

Maria Gouveia[1], Alberto Abreu[1], Carina Félix[2], Artur Alves[1], Ana Cristina Esteves[1]

[1]*CESAM and Department of Biology, University of Aveiro, 3810-193 Aveiro, Portugal*
[2]*MARE-Marine and Environmental Sciences Centre & ARNET—Aquatic Research Network Associated Laboratory, ESTM, Polytechnic of Leiria, 2520-641 Peniche, Portugal*

CONTEXT AND GOALS

Marine-derived fungi are known producers of **enzymes, other proteins and bioactive compounds** – antifungal, antibacterial, cytotoxic, antioxidant, and others.

With the **rise of both bacterial and fungal infections**, it is crucial to find new possible sources of antimicrobial compounds and **enzymes capable of supporting atypical** conditions are import for several industries

This work aimed to:

- Increase marine-derived fungi data in Portugal
- Describe the **enzymatic activity** and the effect of **salinity**
- Describe the **antifungal and antibacterial** activity

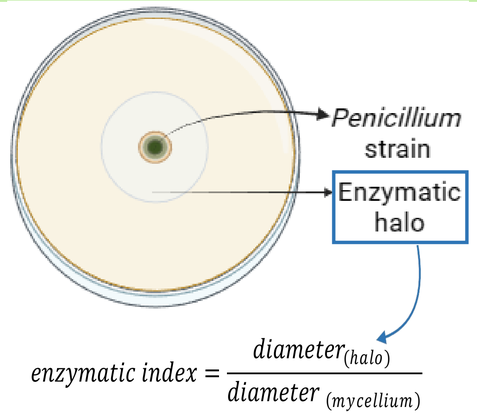
of 18 marine-derived *Penicillium* strains

METHODS

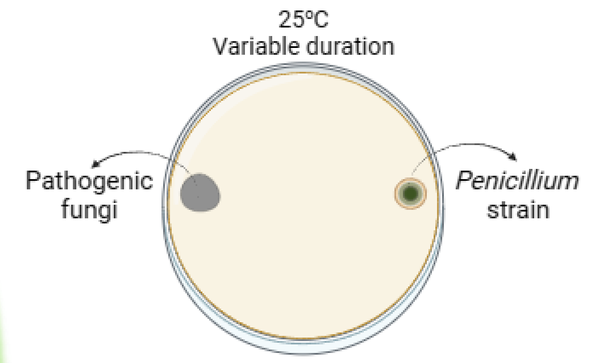
Enzymatic activity assay

- **8** different enzymatic media
- With 3.4% sea salts and without

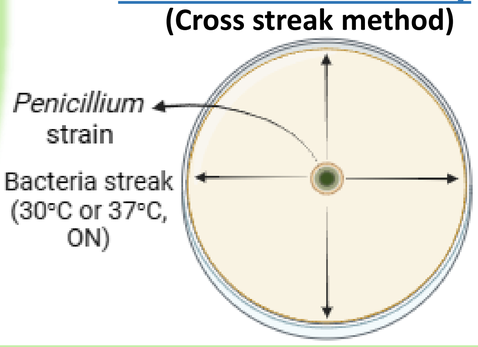
Amylases
Caseinases
Gelatinases
Cellulases
Xylanases
Pectinases
Pectin lyases
Laccases



Antifungal activity
(Dual culture antagonism assay)



Antibacterial activity
(Cross streak method)

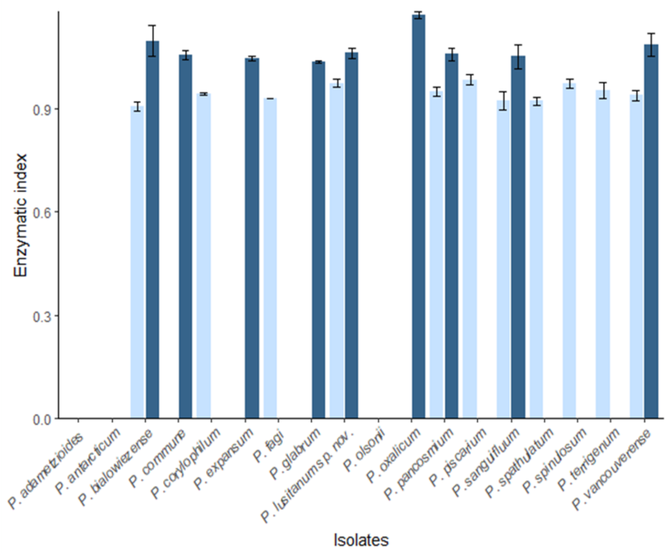


RESULTS

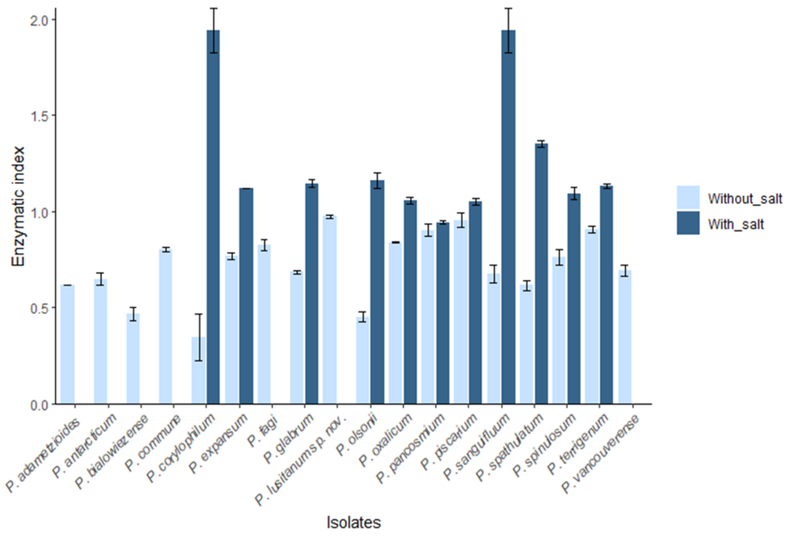
Enzymatic activity

Xylanases **Cellulases**

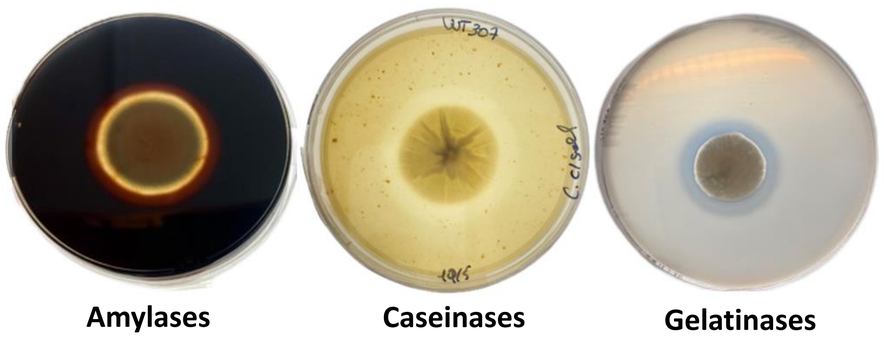
Enzymatic index increased in saline conditions



- **11 *Penicillium*** strains had **xylanolytic** activity in non-saline conditions – 9 strains in saline condition

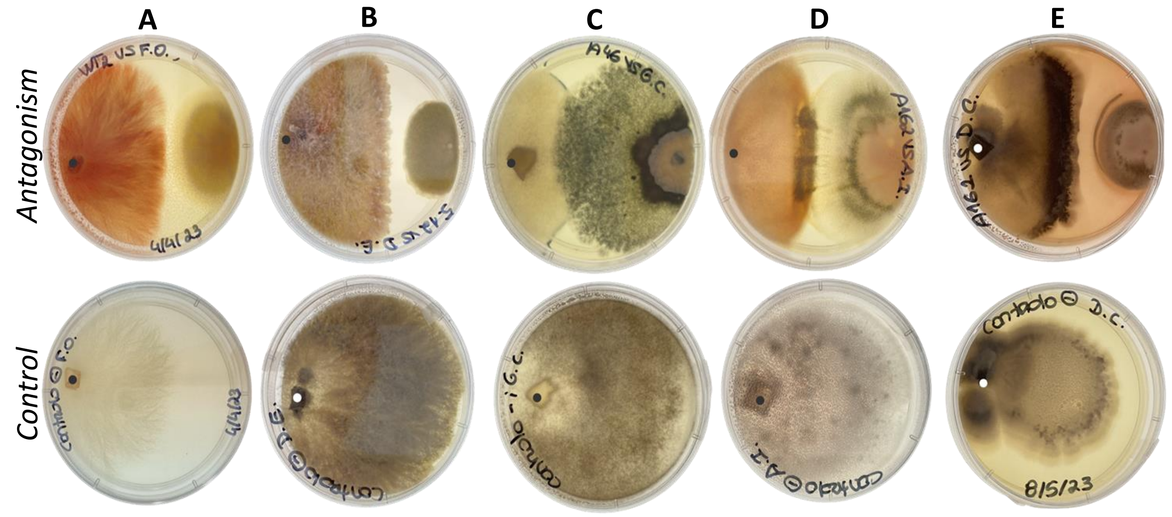


- **All *Penicillium* strains** had **cellulolytic** activity in non-saline conditions – 11 strains in saline conditions



Amylases **Caseinases** **Gelatinases**

- **10 *Penicillium*** strains had **amylolytic activity** in non-saline conditions – 3 maintained activity with sea salts
- **16 *Penicillium*** strains exhibited **caseinase activity** in non-saline conditions – 9 maintained activity with sea salts
- **10 *Penicillium*** strains exhibited **gelatinase activity** in non-saline conditions – no *Penicillium* strains had detectable enzymatic activity in saline condition



Penicillium strains inhibiting the growth of *Fusarium oxysporum* **(A)**; *Diaporthe eres* **(B)**; *Glomerella cingulata* **(C)**; *Alternaria infectoria* **(D)**; *Diplodia corticola* **(E)**

Antibacterial activity

- One *Penicillium* strain with antibacterial activity against ***Aeromonas hydrophila***
- Two *Penicillium* strains with antibacterial activity against ***Staphylococcus aureus***
- **38%** of *Penicillium* strains had antibacterial activity *against Kocuria rhizophila*

Antifungal activity

	Test fungi							
Marine *Penicillium* strains	*Lasiodiplodia theobromae*	*Lasiodiplodia hormozganensis*	*Botrytis cinerea*	*Diaporthe eres*	*Diplodia corticola*	*Alternaria infectoria*	*Fusarium oxysporum*	*Glomerella cingulata*
P. commune	+	+	+	+	+	-	+	-
P. sanguifluum	-	-	+	-	-	-	-	-
P. expansum	+	-	+	-	+	-	+	-
P. adametzioides	+	+	+	+	-	+	+	+
P. corylophilum	+	+	-	-	-	-	-	-
P. oxalicum	+	+	+	+	+	+	-	-
P. piscarium	+	-	-	+	-	-	-	-
P. spinulosum	+	+	+	+	+	-	-	-
P. antarcticum	+	+	+	+	-	-	-	-
P. terrigenum	-	+	+	-	-	+	-	-
P. glabrum	+	+	+	+	+	-	-	-
P. olsonii	-	-	-	+	-	-	+	-
P. bialowiezense	+	+	-	+	+	-	-	-
P. fagi	+	+	+	+	-	+	-	+
P. vancouverense	-	-	+	-	+	+	-	-
P. lusitanum sp. nov.	+	-	-	-	-	-	-	-
P. spathulatum	-	-	+	+	-	+	-	-
P. pancosmium	-	-	+	-	+	+	-	-

- **Human and plant pathogen** *Lasiodiplodia theobromae* was inhibited by 67% of *Penicillium* strains
- **Plant pathogen** *Botrytis cinerea* was inhibited by **72%** of *Penicillium* strains
- **4** *Penicillium* strains showed antagonism towards a *Fusarium* sp (WHO fungal priority pathogen as of 2022)

FINAL REMARKS

- **Caseinases, cellulases and xylanases** were the most observed enzymatic activities among this collection
- **Sea salts** seem to **modulate extracellular enzymatic activity** of these marine-derived *Penicillium* strains
- This marine derived *Penicillium* collection proved to have **antifungal activity** against both **plant and human pathogens**
- We identified *Penicillium* strains with **antagonism against clinical important bacteria** – *Staphylococcus aureus* and *Aeromonas hydrophila*

microlab
Maria Gouveia, mariagouveia@ua.pt
https://biomicrolab.wixsite.com/microlab
@biomicrolab

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