Annales Pharmaceutiques Françaises (2014) 72, 107—111

Disponible en ligne sur ScienceDirect www.sciencedirect.com

Elsevier Masson France EM|consulte www.em-consulte.com

ORIGINAL ARTICLE

Antifungal and antibacterial activity of marine microorganisms

Activité antifongique et antibactérienne des microorganismes marins

B. El Amraoui[a,*], **M. El Amraoui**[a], **N. Cohen**[b], **A. Fassouane**[a]

[a] *Laboratoire de contrôle qualité en bio-industrie et molécules bioactives, faculté des sciences, université Chouaib Doukkali, BP 20, El Jadida 24000, Morocco*
[b] *Service de microbiologie des aliments et de l'environnement, institut Pasteur, Casablanca, Morocco*

Received 31 October 2013; accepted 2 December 2013
Available online 30 December 2013

KEYWORDS
Marine microorganisms;
Antimicrobial activity;
Marine bacteria;
Candida;
Pathogen bacteria

Summary In order to explore marine microorganisms with pharmaceutical potential, marine bacteria, collected from different coastal areas of the Moroccan Atlantic Ocean, were previously isolated from seawater, sediment, marine invertebrates and seaweeds. The antimicrobial activities of these microorganisms were investigated against the pathogens involved in human pathologies. Whole cultures of 34 marine microorganisms were screened for antimicrobial activities using the method of agar diffusion against three Gram-positive bacteria, two Gram-negative bacteria, and against yeast. The results showed that among the 34 isolates studied, 28 (82%) strains have antimicrobial activity against at least one pathogen studied, 11 (32%) strains have antifungal activity and 24 (76%) strains are active against Gram-positive bacteria, while 21 (62%) strains are active against Gram-negative bacteria. Among isolates having antimicrobial activity, 14 were identified and were assigned to the genera *Acinetobacter*, *Aeromonas*, *Alcaligenes*, *Bacillus*, *Chromobacterium*, *Enterococcus*, *Pantoea* and *Pseudomonas*. Due to a competitive role for space and nutrient, the marine microorganisms can produce antibiotic substance; therefore, these marine microorganisms were expected to be potential resources of natural antibiotic products.

* Corresponding author.
E-mail addresses: elamraouibelkassem@yahoo.fr, k.amraoui@hotmail.fr (B. El Amraoui), m.amraoui1@gmail.com (M. El Amraoui), nozha.cohen@pasteur.ma (N. Cohen), azizfassouane@yahoo.fr (A. Fassouane).

0003-4509/$ — see front matter © 2013 Elsevier Masson SAS. All rights reserved.
http://dx.doi.org/10.1016/j.pharma.2013.12.001

MOTS CLÉS
Microorganismes marins ;
Activité antimicrobienne ;
Bactéries marines ;
Candida ;
Bactéries pathogènes

Résumé Afin d'explorer les microorganismes marins ayant un potentiel pharmaceutique, les bactéries marines ont été auparavant isolées à partir de l'eau de mer, des sédiments, des invertébrés marins et des algues provenant de différentes régions côtières de l'océan Atlantique marocain. Les activités antimicrobiennes de ces isolats ont été étudiées contre des germes impliqués dans des pathologies humaines. Les cultures entières de 34 microorganismes marins ont été étudiées pour leurs activités antimicrobiennes en utilisant la méthode de diffusion en milieu solide à partir des puits contre trois bactéries Gram positif, deux bactéries Gram négatif et contre une levure. Les résultats ont montré que parmi les 34 isolats étudiés, 28 (82 %) souches présentent une activité antimicrobienne contre au moins un pathogène étudié, 11 (32 %) souches ont une activité antifongique, et 24 (76 %) souches sont actives contre les bactéries Gram positif, tandis que 21 (62 %) isolats sont actifs contre les bactéries à Gram négatif. Parmi les isolats ayant une activité antimicrobienne, 14 ont été identifiés et ont été assignés aux genres *Acinetobacter*, *Aeromonas*, *Alcaligenes*, *Bacillus*, *Chromobacterium*, *Enterococcus*, *Pantoea* et *Pseudomonas*. En raison de la compétition pour l'espace et les éléments nutritifs, les microorganismes marins pourraient produire des substances antibiotiques ; par conséquent, ces microorganismes marins constituent des ressources potentielles d'antibiotiques naturels.

Introduction

The need for discovery of new and novel antibiotics is imperative for evidence shows that development and spreads of resistance to any new antimicrobial agents is inevitable [1]. The increasing needs for drugs being able to control new illnesses or resistant strains of microorganisms stimulate the necessity to look for unconventional new sources of bioactive natural products. The oceans turned out to be an attractive field [2].

Furthermore, along with the deep studies of marine natural products biosynthesis, some evidence indicates that many bioactive compounds previously found in marine animals and plants were in fact produced or metabolised by associated microorganisms [3,4].

Competition among microbes for space and nutrient is a powerful selection pressure that endows microorganisms to produce many natural products possessing pharmaceutical and therapeutic values [5]. Compared with terrestrial organisms, the secondary metabolites produced by marine organisms have more novel and unique structures owing to the complex living circumstance and diversity of species. Besides, their bioactivities are much stronger [6,7] as well as the number of natural products isolated from marine organisms increases rapidly [1]. Furthermore, hundreds of new compounds are now being discovered every year [8].

Many antimicrobial, antifouling substances have been found among these kinds of bacteria due to the specialized role they play in their respective hosts [9,10]. It is suggested that the primary role of these antibiotic substances could be related to ecological competition [11].

In the present work, we have studied antimicrobial activities of isolated marine bacteria associated with seaweeds and invertebrates in different coastal areas of El Jadida, Morocco.

Materials and methods

Antagonistic microorganisms

Thirty-four marine microorganisms from the culture collection of the Quality Control in Bio-industry and Bioactive Molecules Laboratory (*contrôle qualité en bio-industrie et molécules bioactives*) of the Faculty of Sciences in El Jadida (Morocco) were tested for their antimicrobial activity. These microorganisms have been isolated from different marine hosts (Table 1) [12]. All isolates were stored at −20 °C in nutrient broth [Difco] with 20% glycerol (aliquots in Eppendorf tubes) and at 4 °C in Luria-Bertani agar [Difco] inclined, and they are regularly transplanted (every 6 months).

The identification of marine microorganisms was carried out at the Pasteur Institute of Morocco and confirmed at the Maghreb laboratory, Rabat (Morocco) to the following protocol: the Gram-positive or Gram-negative bacterial differentiation was carried out by the Gram staining. The Gram-positive bacteria are tested for catalase whereas Gram-negative bacteria undergo the oxidase test, and thereafter, according to the results of biochemical tests, a type of gallery is used. Galleries ''ID32 STAPH'' are used for Gram (+), catalase (+), galleries ''ID32 STREP'' for Gram (+), catalase (−). Whereas galleries ''ID32 GN'' for Gram (−), oxidase

Table 1 Isolation origins of the marine microorganisms studied.
Origines de l'isolement des microorganismes marins étudiés.

Origin	Reference of marine microorganisms
Sea water	R2, R3, R7, HR7, O1, H
Saline	J
Marine sediments	K62, L, U1, M2, M3, M4, M5, M6, M7, M8, M9
The tunicate *Microcosmus australis*	E, F, 1P2, 5P2
Muricidae eggs	2N1, N2
The clam *Ruditapes decussata* (*Venerupis decussata*)	AT2, T2, T3, TR2, TR3
The oyster *Grassostrea gigas*	S2, SP2
Red algae	Ks
The mussel *Mytilus galloprovincialis*	1X2, X1