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ORIGINAL ARTICLE/ARTICLE ORIGINAL

A non-polyenic antifungal produced by a *Streptomyces yatensis* strain isolated from Mellah Lake in El Kala, North-East of Algeria



Étude d'une souche Streptomyces yatensis isolée des eaux du lac El Mellah, nord-est de l'Algérie productrice d'un antifongique non polyénique

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KEYWORDS

Antimicrobial activity;
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Mellah Lake;
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Summary

Objective. — This study aimed at describing one actinomycete strain E65 that was isolated from the water of Mellah Lake in El Kala, North-East of Algeria that produces a non-polyenic antifungal. **Materials and methods.** — Actinomycetes were isolated from Mellah Lake water and screened for antimicrobial activity. Antimicrobial assays were performed on ISP2 agar. The taxonomic position of the strain E65 was determined regarding phenotypic and 16S DNA sequences features. Time course of antifungal metabolites production was evaluated against *Candida albicans* on ISP2, ISP1 and GYEA broth. The active antifungal compound was extracted using dichloromethane and revealed by a thin layer of chromatography, chemical reagents, UV-visible and infrared spectroscopy. **Results.** — A total of 104 actinomycetes were isolated and screened for antimicrobial activity; 21 strains were active against *Staphylococcus aureus*, *Escherichia coli* and *Candida albicans*. The strain E65 showed a high *in vitro* activity against *S. aureus* and *C. albicans* and a good antifungal activity against a clinical *C. albicans* strain resistant to 5-fluorocytosine. Its 16S rRNA sequence shared 99% similarity with the *Streptomyces yatensis* type strain within the *Streptomyces violaceusniger* subclade of the *Streptomyces hygroscopicus* clade. It produced a non-polyenic antifungal, the IR

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MOTS CLÉS

Activité antimicrobienne ;
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spectrum of the antifungal extract corresponded to none of the antimicrobials compounds known to be produced by actinomycete of the *S. hygroscopicus* clade.

Conclusion. – The wetlands of El Kala, Algeria are a potential source of bioactive actinomycete that deserves to be explored and exploited. The *Streptomyces yatensis* E65 strain isolated from Mellah Lake brackish water produces a remarkable antifungal compound which original non-polyenic structure warrants further characterization.

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Résumé

Objectif. – L'étude de l'activité antimicrobienne des souches d'actinomycètes isolées du lac El Mellah, parc national d'El Kala, d'établir la position taxonomique de la souche E65 et d'analyser son extrait antifongique.

Matériels et méthodes. – Le *screening* de l'activité antimicrobienne est réalisé sur gélose ISP2, la position taxonomique de la souche E65 est établie à partir des caractères phénotypiques et l'étude moléculaire, la cinétique de croissance et de production des molécules antifongiques sur *Candida albicans* sont étudiés sur bouillon ISP1, ISP2 et GYEA, la molécule antifongique est extraite avec du dichlorométhane et révélée sur chromatographie en couche mince, avec des révélateurs chimiques et une spectroscopie UV-visible et infrarouge.

Résultats. – Un total de 104 souches d'actinomycètes ont été isolées et examinées pour leurs activités antimicrobiennes, 21 souches étaient actives contre *Staphylococcus aureus*, *Escherichia coli* et *Candida albicans*. La souche E65 a montré une forte activité *in vitro* contre *Staphylococcus aureus* et *Candida albicans* et une bonne activité contre une souche *C. albicans* résistante à la 5-fluorocytosine. Cette souche est identifiée comme *Streptomyces yatensis* appartenant au sous-groupe des « *Streptomyces violaceusniger* » du groupe « *Streptomyces hygroscopicus* ». La souche E65 produit un antifongique non polyénique, son spectre infrarouge ne correspond à aucun des composés antimicrobiens connus pour être produit par les souches du groupes « *S. hygroscopicus* ».

Conclusion. – La souche E65 isolée des eaux du lac Mellah d'El Kala en Algérie a donné une molécule antifongique intéressante de nature non polyénique et que la zone humide d'El Kala sont visiblement une source d'actinomycètes bioactifs qui méritent d'être explorées et exploitées.

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Introduction

Numerous hospital-based studies conducted over the last decade reported the emergence of fungal infections mainly caused by *Candida albicans* [1,20,39]. Others also reported the increasing prevalence of resistance of fungi to various antifungal agents. Therefore, the search for new sources of natural antifungal producers is critical [38]. The bioresources of many unusual geographic areas have been studied, especially for isolating actinomycete strains of interest regarding their diversity [35], enzymatic activity [34], or their antimicrobial activity [13,43]. Since 2005, our laboratory is focusing on the study of actinomycetes isolated from lacustrine sites and the screening of strains producing bioactive compounds. Actinomycetes are also studied for their ability to produce a wide range of molecules [6], and known to produce more than 70% of industrial metabolites, such as antibiotics [35].

The present study focused on *Actinomycetes* in the water of the Mellah Lake, which is located within El Kala National Park. The National Park of El Kala was created in 1983 with official presidential decree in order to protect its natural resources; the same year Oubeira and Tonga lake were included to the Ramsar convention. Then, the park was registered into the UNESCO's Man and Biosphere Program and, in 1990, the Mellah Lake was added to the Ramsar

Convention for its international ecological importance and its high bioresources [19]. As illustrated in Fig. 1, Mellah Lake is a coastal lagoon located east of Cape Rosa, north-east of Algeria in which, depending on the tides, saline water is imported through its connection with the Mediterranean Sea at its northern tip [19]. Mellah Lake's water is contaminated with agricultural and urban discharges and its microbiological resources, especially actinomycetes, have never been studied. The aims of this study were to screen for antifungal active compounds produced by actinomycete isolated from the Mellah Lake brackish water to describe the most effective antifungal compound producer strain and characterize this produced antifungal compound.

Methods**Sampling site**

Water samples of the Mellah Lake (Fig. 1) were collected in sterile bottles, kept at 4 °C and transferred immediately to the laboratory. They were then inoculated onto seven different media: ISP1, ISP2, ISP4, ISP5, Gauss, Cross and Casein starch agar, which compositions are detailed in the Table 1. Plates were incubated for 7, 14 and 21 days at 28 °C. Characteristic colonies were subcultured on ISP2 agar and kept at 4 °C [17,31].

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