Kubuqi Desert China; A Promising Source of Antimicrobial and *In Vitro* Anticancer Actinobacteria

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ABSTRACT

The golden era of antibiotic therapy is on the brink of death due to the worldwide spread of antibiotic resistance and less discoveries of effective novel drugs. Natural products (NP) have always been playing a vital role in drug discovery. The compounds derived from natural products (NP) are beneficial for many scientific sectors such as industrial, Pharmaceutical and Biotechnology. Scientists are now focusing on extreme environments like cryo, deep-sea, volcanic and desert ecosystems, because a remarkable number of recent researches have been proving them an excellent source. A collection of hundred actinobacterial strains originated from Kubuqi desert China were investigated for their antimicrobial and in vitro anticancer activity. The metabolic profiling of hundred dereplicated actinobacterial isolates was performed from which selected isolates were prioritized (based on metabolic potential and bioactivity) for scale-up and metabolite isolation/structure elucidation. The results of this study revealed that it could lead to some commercially useful actinomycetes strains and compound.

Keywords: Actinobacteria; Antimicrobial; Anticancer; Chemical profiling; Desert; NMR spectroscopy.

INTRODUCTION

There is need to discover new antimicrobial and anti-cancer drugs to win the battle against multiple drug resistant pathogens. Many drugs currently in practice for clinical therapy are mainly originated from phylum Actinobacteria, which have been reported as a remarkable source of antibacterial, antitumor, antifungal, anti-viral, anti-inflammatory and immunosuppressive activities. Actinobacteria are gram positive, spore forming, filamentous bacteria with high guanine and cytosine content in their DNA. They have the tendency to produce various types of biomolecules of enormous industrial importance. Due to the unpromising results in getting novel species from normal habitats, the search has now shifted towards untapped habitats like deserts. Kubuqi Desert located in inner magnolia China is the seventh biggest desert in China. The Kubuqi desert is 262 meters long and covers an area of about 18,600 sq. km. This would be the first study of its kind which will screen and characterize the actinobacteria isolated from Kubuqi Desert China. Screening of potential actinobacterial strains and their secondary metabolite purification would help to fight back against various cancer types and multidrug resistant pathogens.

OBJECTAIVE

The objectives of the study include;

1- Morphological, biochemical and physiological characterization of the isolated actinobacterial strains originated from Kubuqi desert China.
2- Preliminary screening of selected strains for their antimicrobial activity against different bacterial pathogens.

3- Preliminary biological screening of isolates against different human cancerous cell lines for in- vitro anticancer activity.
4- Biochemical profiling of strain's crude extracts by chromatographic techniques (TLC, HPLC-UV and HPLC-MS).
5- Lab scale fermentation and purification of the active secondary metabolites produced by the bioactive actinobacterial strains
6- Purification and identification of structure of the pure and bioactive compounds by Mass spectrometry, Nuclear magnetic resonance spectroscopy and comparing the data in related data bases.

A collection of hundred actinobacterial strains originated from Kubuqi desert China were investigated for their antimicrobial and in vitro anticancer activity against six bacterial and fungal pathogens including gram positive (B. subtilis (ATCC 6633), S. aureus (ATCC 6538), M. luteus (NRRL B-287)), gram negative (E. coli (NRRL B-3708), S. enterica (ATCC 10708)) and yeast (S. cerevisiae (ATCC 204508)). The two Human cancerous cell lines included adenocarcinoma human epithelial cell line (A549) and human prostate cancer cell line (PC3). The biochemical profiling of methanolic crude extracts was performed by Thin Layer Chromatography, High performance liquid chromatography (HPLC-UV and LC-MS) techniques. The methanolic extracts exhibited promising antimicrobial activity against various gram positive and gram-negative test strains.

CONCLUSION/RESULTS

Among hundred strains screened, the extracts of approximately 20% strains exhibited significant in vitro anticancer activity against tested cell lines. More than 70% strains were promising against gram positive and gram-negative strains. The chemical screening results depicted the presence of active compounds with molecular masses in the range of 200 to 1000 Daltons. Collectively twelve strains from this collection were selected as priority strains for scale-up studies, for the purification and identification of active compounds produced by these strains. Consequently, some of the strains showed presence of new derivatives of compounds active against pathogenic bacteria and cancerous cell lines (Figure **1** and Figure **2**). The study revealed that the actinobacterial strains originated from this site are a promising source of clinically useful/new antimicrobials and various other chemotherapeutic agents.

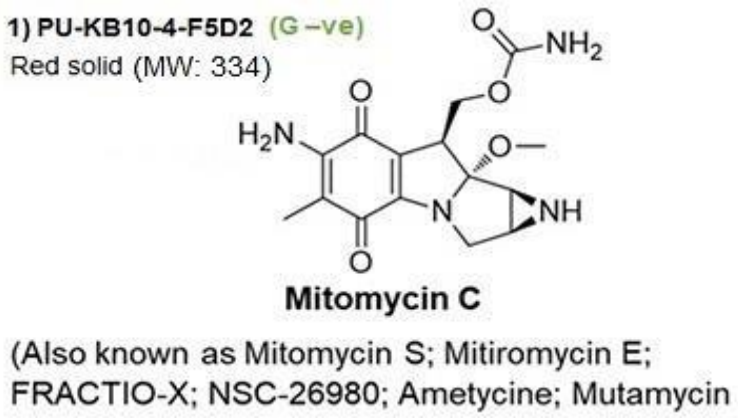

Figure 1. Antigram negative compound Mitomycin C was purified from actinobacterial strain (PU- KB10-4) with molecular weight 334.

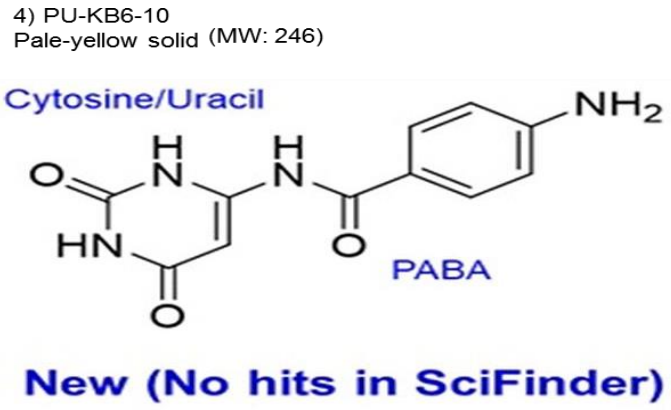

Figure 2. A new compound from actinobacterial strain PU-KB6-10 was purified with molecular weight 246.

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