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Isolation and comparative genomics of soil bacteria with antibacterial activity against Methicillin-resistant *Staphylococcus aureus*

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Abstract

The emergence of multidrug-resistant pathogens has increased the demand for discovery of novel antibiotics. Soil microbial communities are a great resource for natural products buta majority of them have not been explored yet due to the bacterial unculturability. We cultured a collection of over 500 bacterial and fungal isolates from soil usinglow-strength ($1/200^{th}$) nutrient agar supplemented with soil extract with extended period of incubation. Bacterial diversity analysis using 16S rRNA gene sequences of newly cultured isolates revealed that they represent diverse bacterial genera affiliated with the phyla *Acidobacteria*, *Actinobacteria, Bacteroidetes, Firmicutes*, and *Proteobacteria.* Two isolates, designatedas A115 and F4, were found to inhibit the growth of pathogenic methicillin-resistant *Staphylococcus aureus* (MRSA). The isolate A115, member of the genus *Streptomyces*, produces pink pigments after incubation for more than ten days. The isolate F4, identified as *Nonomuraea*, produces a high molecular weight (>100kDa), heat stable reddish pigment with anti-MRSA activity.Whole genome sequencing and bioinformatics prediction demonstrated that A115 and F4 encode a total of 32 and 28 secondary metabolite biosynthesis gene clusters, respectively. A115 encodes Type I, II, and III PKS pathways, whereas F4 encodes Type I and III PKS pathways. The biochemical structure of the active anti-MRSA compounds are currently being characterized usingliquid chromatography–mass spectrometry (LC/MS). This study identified novel bacterial isolates with anti-MRSA activity and demonstrates the utility of novel cultivation techniques in obtaining previously uncultured and phylogenetically diverse soil microorganisms, some of which express potent bioactive secondary metabolites.

Biography

ShamimaNasrin, is a Ph.D. student in Microbiology at Auburn University. She received her Master's degree in Biology from Tuskegee University in 2010. She participates in many academic research projects involved with both prokaryotes and eukaryotes.She was awarded Cancer Research fellowship award in 2009 and Cellular and Molecular biosciences fellowship in 2010. She has published several scientific articles and book chapters, and has presented research papers at several scientific meetings. Her current research focus is to discovery of antibacterial compounds against *Methicillin-resistant Staphylococcus aureus*(*MRSA*) from soil microorganisms using culture-dependent and culture–independent approaches