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Genome Sequencing and Analysis of the Spontaneous Nanosilver Resistant Bacterium Proteus mirabilis Strain scdr1

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Abstract : Background: P. mirabilis is a common uropathogenic bacterium that can cause major complications in patients with long-standing indwelling catheters or patients with urinary tract anomalies. In addition, P. mirabilis is a common cause of chronic osteomyelitis in diabetic foot ulcer (DFU) patients. Methodology: P. mirabilis SCDR1 was isolated from a diabetic ulcer patient. We examined P. mirabilis SCDR1 levels of resistance against nano-silver colloids, the commercial nano-silver and silver containing bandages and commonly used antibiotics. We utilized next generation sequencing techniques (NGS), bioinformatics, phylogenetic analysis and pathogenomics in the identification and characterization of the infectious pathogen. Results: P. mirabilis SCDR1 is a multi-drug resistant isolate that also showed high levels of resistance against nano-silver colloids, nano-silver chitosan composite and the commercially available nano-silver and silver bandages. The P. mirabilis-SCDR1 genome size is 3,815,621 bp with G+C content of 38.44%. P. mirabilis-SCDR1 genome contains a total of 3,533 genes, 3,414 coding DNA sequence genes, 11, 10, 18 rRNAs (5S, 16S, and 23S), and 76 tRNAs. Our isolate contains all the required pathogenicity and virulence factors to establish a successful infection. P. mirabilis SCDR1 isolate is a potential virulent pathogen that despite its original isolation site, wound, it can establish kidney infection and its associated complications. P. mirabilis SCDR1 contains several mechanisms for antibiotics and metals resistance including, biofilm formation, swarming mobility, efflux systems, and enzymatic detoxification. Conclusion: P. mirabilis SCDR1 is the spontaneous nano-silver resistant bacterial strain. P. mirabilis SCDR1 strain contains all reported pathogenic and virulence factors characteristic for the species. In addition, it possesses several mechanisms that may lead to the observed nano-silver resistance.

Keywords : Proteus mirabilis, multi-drug resistance, silver nanoparticles, resistance, next generation sequencing techniques, genome analysis, bioinformatics, phylogeny, pathogenomics, diabetic foot ulcer, xenobiotics, multidrug resistance efflux, biofilm formation, swarming mobility, resistome, glutathione S-transferase, copper/silver efflux system, altruism
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