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Antibiotic Susceptibility and Heavy Metal Tolerance Pattern of Serratia Marcescens Isolated From Soil and Water

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The antibiotic and metal tolerance patterns of *Serratia marcescens* strains isolated from soil and water around the Sangam region of Allahabad were obtained. Using the standard minimum inhibitory concentration (MIC) for each antibiotic respectively, the Kirby-Bauer disc-diffusion method was used to obtain antibiotic resistance patterns of the *Serratia* strains and the MIC of the metals - chromium, cadmium, cobalt, Microorganisms are ubiquitous in nature and are involved in almost all biological processes of life. With rapid urbanization and natural processes, heavy metals have been found in increasing proportions in microbial habitats. Metals have been known to play a major role either directly or indirectly in almost all metabolic processes, growth and development of microorganisms. However, increasing concentrations of metals beyond tolerance levels have forced these organisms to adapt to various biological mechanisms to cope with this condition. Hence, microbes have developed mechanisms like metal efflux systems, complexation, reduction of metal ions or utilization of the metal as a terminal electron acceptor in anaerobic respiration to tolerate heavy metal accumulation. Bacteria that are resistant to such heavy metals and have the ability to grow in high concentrations of these metals play an important role in their biological cycling which has great potential in bioremediation of poorly cultivable soil high in heavy metal content. Heavy metal tolerance has been observed in the Enterobacteriaceae member, Serratia marcescens and has been thought to be attributed to plasmid-borne resistant genes. 8 isolated strains of this microorganism have been used for heavy metal tolerance testing against various metal salts in order to identify specific strains that can be used for removal of particular metals from environments such as soil and water where they are present as pollutants. Antibiotic susceptibility has also emerged as an ever increasing health hazard due to the indiscriminate use of antibiotics. This has led to severe complications in patients especially with gram negative bacterial infections as the number of drugs to combat this category of infections are limited. Multidrug resistance (MDR) can also be caused by another mechanism of accumulation of multiple antibiotic resistance genes each coding for a single copper, lead and nickel for each of the strains were also obtained. Plasmid curing was carried out for specific antibiotic and metal resistances to ascertain plasmid-borne transfer of resistance genes. Results obtained showed that Multi-drug resistant (MDR) strains of *Serratia* were resistant to certain metals as well suggesting specific metal-antibiotic resistant gene patterns in the different strains antibiotic occurring on resistance (R) plasmids. Multi Drug Resistance organisms are posing to be a huge threat in treatment procedures due to the presence of plasmid borne mobile resistance genes that can readily spread through bacterial populations and efflux systems to counter third and even fourth generation cephalosporin.Serratia marcescens, formerly known as Chromobacterium prodigiosin is a gram-negative facultative anaerobe that has emerged in recent times as a nosocomial pathogen. It functions as an opportunistic organism in immunocompromised patients because of its invasive ability to adhere to hospital instrumentation such as catheters, endoscopes and intravenous tubing. Serratia marcescens is one of the major nosocomial pathogen found associated with urinary and respiratory tract infections, endocarditis, osteomyelitis, septicemia, wound infections, eye infections (conjunctivitis) and meningitis. Serratia marcescens is the only pathogenic species in its genus. The organism inhabits a wide variety of ecological niches and causes diseases in plant, vertebrate as well as invertebrate hosts.Various metals such as cadmium, copper, chromium, cobalt, lead and nickel were used for metal tolerance tests against 8 strains of Serratia marcescens as well as antibiotic susceptibility test was conducted for the above mentioned strains using 14 different antibiotics. All the 8 strains were isolated from soil and water near the Sangam region (confluence of the Ganga and Yamuna rivers) of Allahabad. All metals and antibiotics towards which the strains showed resistance (for metals at a particular concentration) were subjected to plasmid curing experiments to determine the likelihood of plasmidborne resistance pattern and relationship between heavy metal and antibiotic resistance genes.