Abstract

Streptomyces are Gram-positive, aerobic bacteria known for their complex secondary metabolism. *Streptomyces* produce a wide spectrum of metabolites, including most of the clinically useful antibiotics of natural origin. They are also extensively studied due to their complex life cycle, which involves vegetative growth and sporulation. In the vegetative phase, they grow as branching hyphae and form a dense mycelium. The elongated cellular compartments of vegetative hyphae contain several copies of a linear chromosome. As a result of nutrient depletion, *Streptomyces* produce aerial hyphae, which then differentiate into chains of unigenomic spores. The transformation of multi-genomic hyphae into chains of spores requires precise coordination of DNA condensation, segregation and synchronous cell divisions. The *Streptomyces* chromosome, like that of other bacteria, is organized thanks to the activity of numerous proteins: topoizomerases, NAPs (**N**ucleoid **A**ssociated **P**roteins) and high molecular weight condensins such as SMC (**S**tructural **M**aintenance of **C**hromosome). This study investigated the influence of HupS and SMC proteins on chromosome organization and cell division during the sporulation of the model organism, *Streptomyces venezuelae*. For this purpose, the entire life cycle of *S. venezuelae* was analyzed microscopically, using the fluorescently labelled proteins - HupA-mCherry as a chromosome marker and FtsZ-YPet as a cell division marker. The results showed that the deletion of *hupS* and *smc* genes causes chromosome decondensation during sporulation and affects cell division resulting in the formation of elongated spores. Moreover, using the immunoprecipitation technique combined with next-generation high-throughput sequencing (ChIP-seq), sites specifically bound by the HupS and SMC proteins were selected and the interdependence of the interactions between both proteins and DNA was demonstrated. The obtained results showed the complementary functions of HupS and SMC proteins during chromosome compaction accompanying *Streptomyces* sporulation.