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Transcriptomic response of phytopathogen Dickeya dadantii to an increase of DNA supercoiling by novel antibiotic seconeolitsin

DNA supercoiling, i.e., the presence of torsional stress in the DNA double helix, is an essential mechanism of bacterial chromosome compaction and affects gene expression. Supercoiling level is mainly regulated by topoisomerase I and DNA gyrase. Inhibiting one of these enzymes with an antibiotic leads to a global supercoiling modification and global gene expression changes. Novobiocin, an antibiotic inhibiting DNA Gyrase, thus inducing relaxation, has already been studied. Genes responding to this relaxation where categorized as "supercoiling sensitive". To study the opposite variation of supercoiling and redefine the notion of "supercoiling sensitive"gene, we have measured the transcriptomic effect of seconeolitsin, a non-marketed antibiotic inhibiting topoisomerase I. Topoisomerase I inhibition has never been tested on Gram-negative bacteria. We have analyzed these RNA sequencing data, studied the chromosomal distribution of responsive genes and characterized them at the functional level. All together, our studies show that conformational changes of the chromosome induce a global transcriptomic response, with little functional enrichment but a non-uniform spatial organization. Moreover, the supercoiling sensitivity is not an intrinsic property of a promoter but depends on physiological state of the cell and the direction of supercoiling variations.

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