Korean Journal of Microbiology (2017) Vol. 53, No. 3, pp. 230-232
DOI https://doi.org/10.7845/kjm.2017.7042

pISSN 0440-2413
eISSN 2383-9902

Note (Genome Announcement)

# Complete genome sequence of *Spirosoma aerolatum* KACC 17939$^T$, a bacterium related to the DNA repair

**Dong-Uk Kim, Ju-Young Kim, Su Jeong Kim, Min Ji Kim, Ju Yeon Lee, and Myung Kyum Kim***

*Department of Bio and Environmental Technology, College of Natural Science, Seoul Women's University, Seoul 01797, Republic of Korea*

# DNA 복원에 관련된 박테리아 *Spirosoma aerolatum* KACC 17939$^T$의 완전한 게놈 서열

**김동욱 · 김주영 · 김수정 · 김민지 · 이주연 · 김명겸***

서울여자대학교 자연과학대학 생명환경공학과

(Received July 3, 2017; Revised September 12, 2017; Accepted September 20, 2017)

A Gram-stain-negative, yellow-pigmented bacterial strain, designated *Spirosoma aerolatum* KACC 17939$^T$, was isolated from a biofilm of car air conditioner collected in Republic of Korea. In this study, we report the complete genome sequence of a bacterium *Spirosoma aerolatum* KACC 17939$^T$ obtained using the PacBio RS II platform. The genome comprised of 7,959,595 bp with the G + C content of 48.3%, the genome included 6,640 genes were predicted, among them, 6,471 genes are protein-coding genes.

**Keywords:** *Spirosoma*, air conditioner, biofilm, PacBio RS II

The genus *Spirosoma* is a member of the family *Flexibacteraceae* and was first proposed by Larkin & Borrall (1984). In this genus, cells are Gram-strain-negative, non-spore-forming, non-motile or motile, and produce yellow pigment not belonging to the flexirubin type. Members of this genus contain summed feature 3 (comprising iso-$C_{15:0}$ 2-OH and/or $C_{16:1}$ *ω7c*), $C_{16:1}$ *ω5c*, iso-$C_{15:0}$, and $C_{16:0}$ as major cellular fatty acids (Finster *et al*., 2009) and have a DNA G + C content of 47.2–57.0 mol% (Ahn *et al*., 2014). In this study, we report a complete genome sequence of *Spirosoma aerolatum* KACC 17939$^T$ isolated from biofilms growing on the surface of motor car evaporators. (Kim *et al*., 2015). Strain KACC 17939$^T$ is characterized as a Gram-stain-negative, facultatively anaerobic, non spore-forming, rod-shaped bacterium, belongs to the family *Flexibacteraceae*. *Spirosoma aerolatum* KACC 17939$^T$ is the first reported species isolated from artificial materials like a surface of car air conditioner in the genus Spirosoma. Furthermore, DNA repair function of this strain is remarkably important for study on microbial diversity in artificial surface and ecological niche. In this reasons, we sequenced and analyzed the genome of *Spirosoma aerolatum* KACC 17939$^T$.

The genomic DNA was extracted using a genomic DNA purification kit (Promega). A library was constructed according to Pacific Biosciences RS II sequencing method manual. The 153,181 sequencing reads were obtained and were assembled using the PacBio SMRT Analysis (version, 2.3.0) with default options. Genome sequencing and annotation were carried out using Pacific Biosciences RS II platform. CGview software was used to construct the genome map (Grant and Stothard, 2008). The final assembly resulted in 1 contig generating corresponding genome size of 7,959,595 bp. The protein-coding

***For correspondence.** E-mail: biotech@swu.ac.kr;
Tel.: +82-2-970-5667; Fax: +82-2-970-5974

sequences (CDS), rRNA, tRNA and the genome annotation was performed by NCBI Prokaryotic Genome Automatic Annotation Pipeline (PGAP, http://www.ncbi.nlm.nih.gov/books/NBK174280/) (Tatusova *et al.*, 2013). The genome of strain KACC 17939$^{T}$ consists of a circular chromosome of the size 7,959,595 bp with the GC content of 48.3%. A total of 6,640 genes were predicted, among them, 6,471 genes are protein-coding genes, 9 rRNA genes, 43 tRNA genes and 115 pseudogene were assigned (Fig. 1 and Table 1). *Spirosoma aerolatum* KACC 17939$^{T}$ contains the ATP-dependent proteolysis in bacteria, UvrABC system and bacterial MutL-MutS system for DNA repair. The cluster of genes involved in the nucleotide excision repair (NER). Notably, *Spirosoma aerolatum* KACC 17939$^{T}$ includes two copies of excinuclease ABC subunit A (UvrA), this is same as *Deinococcus* species. The *Spirosoma aerolatum* KACC 17939$^{T}$ is available at KACC 17939$^{T}$ and NBRC 110794$^{T}$.

**Table 1. Genome features of *Spirosoma aerolatum* KACC 17939$^{T}$.**

| Attribute | Value |
|---|---|
| Genome size (bp) | 7,959,595 |
| DNA G+C content (bp) | 48.3% |
| No. of contigs | 1 |
| Total genes | 6,640 |
| Protein-coding genes | 6,471 |
| rRNA | 9 |
| tRNA | 43 |
| Pseudogene | 115 |

## Nucleotide sequence accession number

The genome sequence was deposited in DDBJ/EMBL/

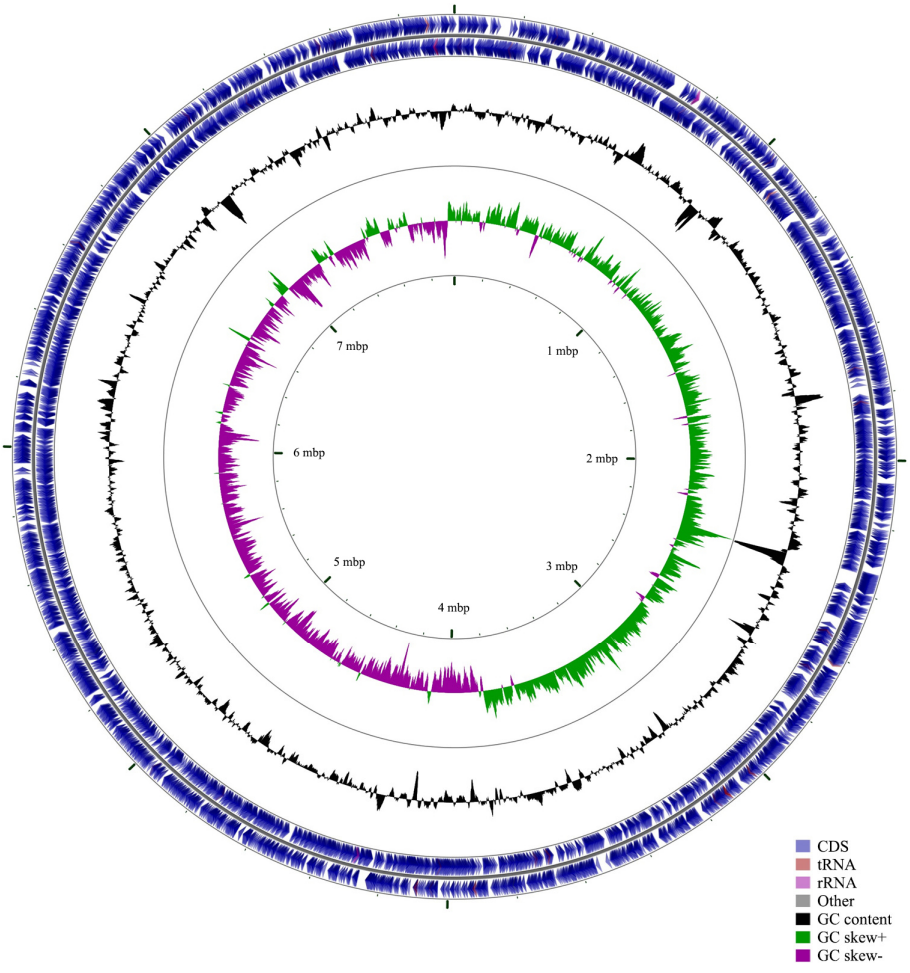


**Fig. 1. Graphical circular map of *Spirosoma aerolatum* KACC 17939$^{T}$.** From outside to the center: Genes on forward strand, Genes on reverse strand, RNA genes (tRNAs peach, rRNAs pink, other RNAs grey), GC content, GC skew.

GenBank under the under the accession number CP020104.

## 적 요

이 연구에서는 자동차의 에어컨의 바이오필름환경에서 분리 된 *Spirosoma aerolatum* KACC 17939$^{T}$의 완전한 게놈 서열을 분석하였다. 이 게놈은 G + C 함량이 48.3%인 7,959,595 bp으로 구성되어 있고 6,471개의 유전자와 6,471개의 단백질 코딩 유전자, 9개의 rRNA 유전자 그리고 43개의 tRNA 유전자 및 115개의 위유전자(pseudogene)를 포함하고 있다.

## Acknowledgements

This research was supported by the MIST (Ministry of Science and ICT), Korea, under the National Program for Excellence in SW supervised by the IITP (Institute for Information and communications Technology Promotion) (2016-0-00022).

## References

**Ahn, J.H., Weon, H.Y., Kim, S.J., Hong, S.B., Seok, S.J., and Kwon, S.W.** 2014. *Spirosoma oryzae* sp. nov., isolated from rice soil and emended description of the genus *Spirosoma*. *Int. J. Syst. Evol. Microbiol.* **64**, 3230-3234.

**Finster, K.W., Herbert, R.A., and Lomstein, B.A.** 2009. *Spirosoma spitsbergense* sp. nov. and *Spirosoma luteum* sp. nov., isolated from a high Arctic permafrost soil, and emended description of the genus *Spirosoma*. *Int. J. Syst. Evol. Microbiol.* **59**, 839-844.

**Grant, J.R. and Stothard, P.** 2008. The CGView Server: A comparative genomics tool for circular genomes. *Nucleic. Acids. Res.* **36**, W181-W184.

**Garrity, G.M. and Holt, J.G.** 2001. The road map to the manual. pp. 119-166. *In* Boone, D.R., Castenholz, R.W., and Garrity, G.M. (eds.), Bergey's Manual of Systematic Bacteriology, 2nd ed. Springer, New York, USA.

**Kim, D.U., Lee, H., Kim, S.G., Ahn, J.H., Park, S.Y., and Ka, J.O.** 2015. *Spirosoma aerolatum* sp. nov., isolated from a motor car air conditioning system. *Int. J. Syst. Evol. Microbiol.* **65**, 4003-4007.

**Larkin, J.M. and Borrall, R.** 1984. Family I. *Spirosomaceae* Larkin and Borrall 1978, 595AL. pp. 125-126. *In* Krieg, N.R. and Holt, J.G. (eds.), Bergey's Manual of Systematic Bacteriology, Williams & Wilkins, Baltimore, USA.

**Tatusova T., DiCuccio, M., Badretdin, A., Chetvernin, V., Ciufo, S., and Li, W.** 2013. Prokaryotic Genome Annotation Pipeline The NCBI Handbook [Internet] 2nd ed. pp. 1-23. National Center for Biotechnology Information, Bethesda, MD, USA.