

Draft Genome Sequence of *Elizabethkingia anophelis* Strain EM361-97 Isolated from the Blood of a Cancer Patient

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***Elizabethkingia anophelis* EM361-97 was isolated from the blood of a patient with nasopharyngeal carcinoma and lung cancer. We report the draft genome sequence of EM361-97, which contains a G+C content of 35.7% and 3,611 candidate protein-encoding genes.**

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Elizabethkingia, previously belonging to genus *Flavobacterium* and then *Chryseobacterium*, is a Gram-negative, nonfermentative rod that is ubiquitously distributed in soil, water, and reservoirs (1). This microorganism has rarely been reported to cause diseases in humans before. However, *Elizabethkingia* has recently emerged as an important pathogen in the opportunistic infections of immunocompromised patients and neonates. The most common infections of *Elizabethkingia* include pneumonia, bacteremia, meningitis, and neutropenic fever (2–4). The genus *Elizabethkingia* includes four species: *E. meningoseptica*, *E. miricola*, *E. anophelis*, and *E. endophytica* (5). *E. anophelis*, first isolated from the mosquito *Anopheles gambiae* in 2011, has caused several outbreaks of infections in the United States (3) and Hong Kong (4). Infections of *E. anophelis* are associated with a mortality rate of 24% to 30% in humans (3, 4).

E. anophelis strain EM361-97 was isolated from the blood of a patient with advanced nasopharyngeal carcinoma and lung cancer in Taiwan. This patient has received several courses of radiotherapy and chemotherapy. This isolate was identified as *E. anophelis* according to the results of 16S rRNA gene sequencing (6).

Total DNA of the isolate was prepared using a Wizard genomic DNA purification kit according to the manufacturer's instructions (Promega, WI, USA). The genomic DNA was sequenced using an Illumina HiSeq 2000 sequencing platform (Illumina, CA, USA). A total of 1,463 Mb data was produced and the short reads were assembled into a genome sequence using the SOAP *de novo* method (7). The total length of the draft genome was 4,077,699 bp with a mean G+C content of 35.7%. The assembly contained 26 scaffolds and 27 contigs. Gene prediction was performed by the NCBI Prokaryotic Genome Annotation Pipeline (8). The methods of best-placed reference protein set and GeneMarkS+ were used for the annotation of genes, coding sequences (CDSs), rRNAs, tRNAs, noncoding RNAs (ncRNAs), and repeat regions (8). A total of 3,738 genes and 3,663 CDSs were identified. The total length of genes makes up approximately 87.9% of genome. There were 52 pseudo genes. The predicted number of coding

genes was 3,611. The number of RNA genes was 75, including 21 rRNAs (5S: 5; 16S: 7; 23S: 9), 51 tRNAs, and three ncRNAs.

Among the species of genus *Elizabethkingia*, *E. meningoseptica* is the most well-known species (9–11). In contrast, less information is available about the epidemiology, virulence factors, antibiotics resistance, and clinical manifestations of *E. anophelis*. Knowledge of the genome sequence of *E. anophelis* will provide researchers important information to understand the pathogenicity of this emerging microorganism.

Accession number(s). This whole-genome shotgun project has been deposited at GenBank under the accession number [LWDS000000000](https://www.ncbi.nlm.nih.gov/nuccore/LWDS000000000).

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REFERENCES

- Henriques IS, Araújo S, Azevedo JSN, Alves MS, Chouchani C, Pereira A, Correia A. 2012. Prevalence and diversity of carbapenem-resistant bacteria in untreated drinking water in Portugal. *Microb Drug Resist* 18: 531–537. <http://dx.doi.org/10.1089/mdr.2012.0029>.
- da Silva PSL, Pereira GH. 2013. *Elizabethkingia meningoseptica*: emergent bacteria causing pneumonia in a critically ill child. *Pediatr Int* 55:231–234. <http://dx.doi.org/10.1111/j.1442-200X.2012.03650.x>.
- Wisconsin Department of Health Services, Division of Public Health. 2016. Wisconsin 2016 *Elizabethkingia anophelis* outbreak. Accessed: 4 September 2016. <https://www.dhs.wisconsin.gov/disease/elizabethkingia.htm>.
- Lau SKP, Chow WN, Foo C-H, Curreem SOT, Lo GC-S, Teng JLL, Chen JHK, Ng RHY, Wu AKL, Cheung IYY, Chau SKY, Lung DC, Lee RA, Tse CWS, Fung KSC, Que TL, Woo PCY. 2016. *Elizabethkingia anophelis* bacteremia is associated with clinically significant infections and high mortality. *Sci Rep* 6:26045. <http://dx.doi.org/10.1038/srep26045>.

5. Nicholson AC, Humrighouse BW, Graziano JC, Emery B, McQuiston JR. 2016. Draft genome sequences of strains representing each of the *Elizabethkingia* genomospecies previously determined by DNA-DNA hybridization. *Genome Announc* 4(2):e00045-16. <http://dx.doi.org/10.1128/genomeA.00045-16>.
6. Hantsis-Zacharov E, Shakéd T, Senderovich Y, Halpern M. 2008. *Chryseobacterium oranimense* sp. nov., a psychrotolerant, proteolytic and lipolytic bacterium isolated from raw cow's milk. *Int J Syst Evol Microbiol* 58:2635–2639. <http://dx.doi.org/10.1099/ijs.0.65819-0>.
7. Li R, Li Y, Kristiansen K, Wang J. 2008. SOAP: short oligonucleotide alignment program. *Bioinformatics* 24:713–714. <http://dx.doi.org/10.1093/bioinformatics/btn025>.
8. Tatusova T, DiCuccio M, Badretdin A, Chetvernin V, Nawrocki EP, Zaslavsky L, Lomsadze A, Pruitt KD, Borodovsky M, Ostell J. 2016. NCBI prokaryotic genome annotation pipeline. *Nucleic Acids Res* 44: 6614–6624. <http://dx.doi.org/10.1093/nar/gkw569>.
9. Sun G, Wang L, Bao C, Li T, Ma L, Chen L. 2015. Complete genome sequence of *Elizabethkingia meningoseptica*, isolated from a T-cell non-Hodgkin's lymphoma patient. *Genome Announc* 3(3):e00673-15. <http://dx.doi.org/10.1128/genomeA.00673-15>.
10. Moore LSP, Owens DS, Jepson A, Turton JF, Ashworth S, Donaldson H, Holmes AH. 2016. Waterborne *Elizabethkingia meningoseptica* in adult critical care. *Emerg Infect Dis* 22:9–17. <http://dx.doi.org/10.3201/eid2201.150139>.
11. Rastogi N, Mathur P, Bindra A, Goyal K, Sokhal N, Kumar S, Sagar S, Aggarwal R, Soni KD, Tandon V. 2016. Infections due to *Elizabethkingia meningoseptica* in critically injured trauma patients: a seven-year study. *J Hosp Infect* 92:30–32. <http://dx.doi.org/10.1016/j.jhin.2015.07.008>.