

Salmonella Typhimurium

Background: *Salmonella enterica* subsp. *enterica* serovar Typhimurium (antigenic formula 4,5,12:i:1,2) is a serovar of the O:4 (B) serogroup. *S. Typhimurium* is a widely distributed serovar, which represent the second most common serovar isolated from humans in the United States and Europe. There is one variant named *S. Typhimurium* var. Copenhagen, which lacks the factor 5 in the O antigen (4,12:i:1,2). This serovar was named Typhimurium because it produces "Typhi like symptoms in the murine model. *S. Typhimurium* has been used as model to understand the pathogenicity of *Salmonella*. *S. Typhimurium* can cause disease in a wide range of hosts and invasive strains have been reported in some [countries in Africa](#). This serovar is classified according to the susceptibility to typing phages, in definite phage types (DT); one common DT ([DT104](#)) has been found to have resistance to ampicillin, chloramphenicol, streptomycin, sulphonamide and tetracycline (ACSSuT resistance type). In England, two outbreaks caused by a multidrug resistant (MDR) strain (ASSuTTm resistant type) of *S. Typhimurium* [DT120](#) occurred in 2011.

Animal reservoir: Serovar Typhimurium is found in multiple animal species, including cattle, poultry, swine, wild animals and insects.

Geographical distribution: Serovar Typhimurium is globally distributed. In multiple locations (i.e., U.S., Europe, Africa and Latin America), it is reported as the second most common *Salmonella* serovar in humans. In Australia, it is the most common serovar in humans. In Asia, it is among the ten most common serovars in humans.

Outbreaks: Numerous outbreaks have been associated with *S. Typhimurium*. Outbreaks have been linked to a number of foods and to contact with animals (chicks, ducklings, and other live baby poultry). Here we mention some of the latest outbreaks caused by this serovar.

Year	Location	Associated source	Number of cases
2018	US-multistate	Chicken salad	265
2018	US-multistate	Dried Coconut	14
2013	US-multistate	Live poultry	37
2013	US-multistate	Ground beef	22
2012	Canada	Ground beef	50
2012	US-multistate	Pet Hedgehogs	26
2012	US-multistate	Cantaloupe	261
2011	US-multistate	Ground beef	20
2011	US-multistate	African Dwarf Frogs	241
2011	England	Pork	51
2011	Ireland	Duck eggs	34
2010	US-multistate	Contact with water frogs	85
2009	England	unknown	14

Border Rejections and Recalls:

Year	Exporting Country (if applicable)	Country Issuing Recall/Rejection	Food
2019	Poland	Poland	Turkey
2019	Belgium	Germany	Frozen Pig Intestines

Relevant genetic characteristics: Whole genome sequences for 27 strains of *S. Typhimurium* have been deposited at GenBank as of October, 2013. Genomic characteristics of the sequenced *S. Typhimurium* strains include (i) a genome size ranging from 4.82- 5.09 Mb, (ii) a mol G+C% of approx. 52.2, and (iii) 4,556 to 5,619 predicted genes. Most of the strains of *S. Typhimurium* contain a plasmid of approx. 90 kb that carry virulence genes (*Salmonella* virulence plasmid ([SVP](#))). Large resistant plasmids of approx. 200 kb that represented different incompatibility types (e.g., IncHI1), have also been identified in *S. Typhimurium*. Prophages and genomic islands are important genomic components of serovar Typhimurium; for example, *S. Typhimurium* str. [LT2](#) has four prophages (Fels-1, Fels-2, Gifsy-1, and Gifsy-2). Pathogenicity islands (SPIs) are found in all *S. Typhimurium* sequenced to date, this include SPIs-1 to 6, 9, 11 to 14, and 16; being SPI-14 specific to *S. Typhimurium*. In addition, some genomic islands are strain-specific; for example, *S. Typhimurium* MDR strain [ST1660/06](#) has three strain-specific genomic islands that encode putative virulence and resistance genes. Genomic islands that encode antibiotic resistance appear to be a common feature of a number of *S. Typhimurium* MDR strains, these genomic islands include, e.g., *Salmonella* genomic island 1 (SGI1) described in *S. Typhimurium* DT104 and genomic island GI-DT12 in *S. Typhimurium* [T000240](#). The latest genomic island (GI-DT12) contains antibiotic resistance genes (i.e., *bla(oxa-30)*, *aadA1*, *qacE1*, and *sul1*, *cat*, and *tetA*) and virulence genes (i.e., the aerobactin iron-acquisition siderophore system (*lutA* and *lucABC*), and an iron transporter (*sitABCD*)).

In Sub-Sahara regions of Africa, [invasive strains](#) of *S. Typhimurium* emerged, single nucleotide polymorphism (SNP)-based phylogeny of these invasive strains and strains from other regions, showed two lineages of invasive strains that clustered together. According to [den Bakker et al.](#) (2011) classification, *Salmonella Typhimurium* belongs to clade A.

Genome sequences available:

1. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. LT2 <http://www.ncbi.nlm.nih.gov/assembly/28528/>
2. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. 14028S <http://www.ncbi.nlm.nih.gov/assembly/359508/>

3. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. 798 <http://www.ncbi.nlm.nih.gov/assembly/368468/>
4. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. D23580 <http://www.ncbi.nlm.nih.gov/assembly/359488/>
5. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. SL1344 <http://www.ncbi.nlm.nih.gov/assembly/445688/>
6. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. ST4/74 <http://www.ncbi.nlm.nih.gov/assembly/378298/>
7. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. T000240 <http://www.ncbi.nlm.nih.gov/assembly/407038/>
8. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. U288 <http://www.ncbi.nlm.nih.gov/assembly/608548/>
9. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. UK1 <http://www.ncbi.nlm.nih.gov/assembly/360258/>
10. *Salmonella enterica* subsp. *enterica* serovar Typhimurium var-5 str. CFSAN001921 <http://www.ncbi.nlm.nih.gov/assembly/41141/>
11. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. ST1489 <http://www.ncbi.nlm.nih.gov/assembly/62931/>
12. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. ST1660/06 <http://www.ncbi.nlm.nih.gov/assembly/546838/>
13. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. ST4848 <http://www.ncbi.nlm.nih.gov/assembly/64311/>
14. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. ST78896 <http://www.ncbi.nlm.nih.gov/assembly/62921/>
15. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. STm1 <http://www.ncbi.nlm.nih.gov/assembly/493428/>
16. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. STm10 <http://www.ncbi.nlm.nih.gov/assembly/503588/>
17. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. STm11 <http://www.ncbi.nlm.nih.gov/assembly/503608/>
18. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. STm12 <http://www.ncbi.nlm.nih.gov/assembly/503628/>
19. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. STm2 <http://www.ncbi.nlm.nih.gov/assembly/499908/>
20. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. STm3 <http://www.ncbi.nlm.nih.gov/assembly/503528/>
21. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. STm4 <http://www.ncbi.nlm.nih.gov/assembly/503548/>
22. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. STm5 <http://www.ncbi.nlm.nih.gov/assembly/503648/>
23. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. STm6 <http://www.ncbi.nlm.nih.gov/assembly/503568/>
24. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. STm7 <http://www.ncbi.nlm.nih.gov/assembly/47901/>
25. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. STm8 <http://www.ncbi.nlm.nih.gov/assembly/503508/>
26. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. STm9 <http://www.ncbi.nlm.nih.gov/assembly/506978/>
27. *Salmonella enterica* subsp. *enterica* serovar Typhimurium str. TN061786 <http://www.ncbi.nlm.nih.gov/assembly/356608/>

Relevant links and references:

1. http://online.liebertpub.com/doi/abs/10.1089/fpd.2013.1513#utm_source=ETOC&utm_medium=email&utm_campaign=fpd
2. <http://www.nature.com/nature/journal/v413/n6858/full/413852a0.html>
3. <http://www.ncbi.nlm.nih.gov/pubmed/23023330>
4. <http://www.ncbi.nlm.nih.gov/pubmed/23105062>
5. <http://www.ncbi.nlm.nih.gov/pubmed/21622747>
6. <http://www.ncbi.nlm.nih.gov/pubmed/24129621>
7. <http://www.biomedcentral.com/1471-2164/12/425>
8. <http://www.ncbi.nlm.nih.gov/pubmed/21098248>
9. <https://www.cdc.gov/salmonella/typhimurium-02-18/index.html>
10. <https://www.cdc.gov/salmonella/typhimurium-03-18/index.html>
11. <http://analytics.foodtrack.net/cgi-bin/read?rid=MjAxOTAyMjExMzQ0Rk9PRFRSQ0tCVUxMRVRTXzAyMjExOUw0MjY=&style=html&source=email>