

Faculty of Resource Science and Technology

Diet-Driven Microbial Dynamics, Pathogen Profiles, and Transcriptomics in Bats: Bioinformatics Insights Into Gut Microbiomes and Gene Expression

Muhd Amsyari Bin Morni

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A thesis submitted

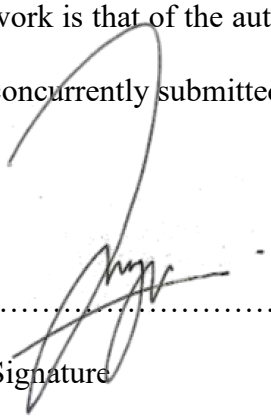
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DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Malaysia Sarawak. Except where due acknowledgements have been made, the work is that of the author alone. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.



……

Signature

Name: Muhd Amsyari Bin Morni

Matric No.: 20010015

Faculty of Resource Science and Technology

Universiti Malaysia Sarawak

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ABSTRACT

This thesis reports a comprehensive study of Bornean bats, focusing on their gut microbiome dynamics, pathogenic bacteria, antimicrobial resistance bacteria, and gene expressions from bats of different dietary preferences. Despite the increasing interest in bats as ecological keystone species and potential zoonotic reservoirs, significant gaps remain in understanding their gut microbiomes and functional gene expression, particularly in Southeast Asia. Current studies often overlook the influence of dietary guilds, such as insectivorous and phytophagous diets, on microbial diversity and functional adaptations. Moreover, the role of bat gut microbiota in antimicrobial resistance and zoonotic pathogen transmission remains largely unexplored. Addressing these gaps is crucial for understanding bat health, their ecological roles, and potential public health implications. Firmicutes, Proteobacteria, and Campylobacterota were detected in both insectivorous (insect-based) and phytophagous (plant-based) bats. Both insectivorous and phytophagous groups exhibited no dominant taxon (D = 0.076; = 0.085). The correlation network analysis revealed a negative relationship between *Lactobacillus*, a type of "good bacteria," and pathogenic bacteria like *Salmonella* (-0.4124) and *Yersinia* (-0.4654). Some of the medically important pathogenic bacteria detected were *Citrobacter koseri* (e.g., infant meningitis), *Enterococcus faecalis* (e.g., endocarditis), *Escherichia coli* (e.g., bloody diarrhoea), and *Shigella sonnei* (e.g., bloody diarrhoea). These bats were detected to be resistant to many antibiotics, such as spectinomycin, tetracycline, kasugamicin, gentamicin, streptomycin, edeine, neomycin, tobramycin, paromomycin, kanamycin, viomycin, and hygromycin B. Through transcriptomic study, it has been identified that bats that prefer a plant-based diet exhibit a highly prevalent genetic expression associated with carbohydrate digestion and vitamin absorption metabolic pathways. In contrast, insectivorous bats emphasised the metabolic

pathway for xenobiotics and the immune defence mechanism against pathogenic substances transported by their prey. This study has successfully report and discussed three chapters related to their gut microbiome dynamics, the presence of pathogenic and antimicrobial-resistant bacteria, and the genetic expressions linked to various dietary preferences.

Keywords: Metagenomic, third-generation sequencing, de-novo transcriptome, Chiroptera, bacteria, pathogenic, antimicrobial resistance

Memahami Kelawar – Membongkar Mikrobiom Usus dan Ekspresi Gen Daripada Pelbagai Sumber Pemakanan Menggunakan Bioinformatik

ABSTRAK

Tesis ini melaporkan kajian komprehensif mengenai kelawar Borneo, dengan fokus pada dinamik mikrobiom usus, bakteria patogen, bakteria rintangan antimikrob, dan ekspresi gen daripada kelawar dengan keutamaan diet yang berbeza. Walaupun minat terhadap kelawar sebagai spesies kunci ekologi dan zoonotik berpotensi semakin meningkat, masih terdapat jurang yang ketara dalam memahami mikrobiom usus dan ekspresi gen fungsian mereka, terutamanya di Asia Tenggara. Kajian semasa sering mengabaikan pengaruh kategori diet, seperti pemakan serangga dan pemakan tumbuhan, terhadap kepelbagaian mikrob dan penyesuaian fungsi. Selain itu, peranan mikrobiota usus kelawar dalam rintangan antimikrob dan penularan patogen zoonotik masih kurang diterokai. Menangani jurang ini adalah penting untuk memahami kesihatan kelawar, peranan ekologi mereka, dan implikasi kesihatan awam yang berpotensi. Firmicutes, Proteobacteria, dan Campylobacterota dikesan dalam kedua-dua kelawar pemakan serangga dan pemakan tumbuhan. Kedua-dua kumpulan ini tidak menunjukkan takson dominan (D = 0.076; = 0.085). Analisis rangkaian korelasi menunjukkan hubungan negatif antara Lactobacillus, sejenis "bakteria baik", dengan bakteria patogen seperti Salmonella (-0.4124) dan Yersinia (-0.4654). Beberapa bakteria patogen yang penting dalam bidang perubatan yang dikesan termasuk Citrobacter koseri (contoh: meningitis bayi), Enterococcus faecalis (contoh: endokarditis), Escherichia coli (contoh: cirit-birit berdarah), dan Shigella sonnei (contoh: cirit-birit berdarah). Kelawar ini juga didapati resistan terhadap banyak antibiotik, seperti spectinomycin, tetracycline, kasugamicin, gentamicin, streptomycin, edeine, neomycin, tobramycin, paromomycin, kanamycin, viomycin, dan hygromycin B. Melalui kajian transkriptomik,

telah dikenal pasti bahawa kelawar yang lebih mengutamakan diet berasaskan tumbuhan menunjukkan ekspresi genetik yang sangat dominan berkaitan dengan penghadaman karbohidrat dan penyerapan vitamin dalam laluan metabolik mereka. Sebaliknya, kelawar pemakan serangga lebih menekankan laluan metabolik untuk xenobiotik serta mekanisme pertahanan imun terhadap bahan patogen yang dibawa oleh mangsa mereka. Kajian ini telah berjaya melaporkan dan membincangkan tiga bab berkaitan dengan dinamik mikrobiom usus, kehadiran bakteria patogen dan rintangan antimikrob, serta ekspresi genetik yang dikaitkan dengan pelbagai keutamaan diet.

Kata kunci: *Metagenomik, penjujukan generasi seterusnya, transkriptom de-novo, Chiroptera, bakteria, pathogen, kerintangan antibiotik*

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LIST OF ABBREVIATIONS

1-D	Simpson diversity index
Abbv.	Abbreviation
AMR	Antimicrobial Resistance Gene
ANOSIM	analysis of similarities
ARO	antibiotic-resistance ontology
ATP	Adenosine Triphosphate
BLAST	Basic Local Alignment Search Tool
BP	Biological process
BUSCO	benchmarking universal single-copy orthologs
CARD	Comprehensive Antibiotic Resistance Database
CC	Cellular component
CDC	Centers for Disease Control and Prevention
cDNA	Complementary DNA
CEL	carboxyl ester lipase
D	dominance
DEGs	GO Differently Expressed Genes
DNA	Deoxyribonucleic acid
dTTP	deoxythymidine triphosphate
E.g.	exempli gratia (For example)
$e^{H/S}$	Evenness
EHEC	Enterohemorrhagic *E. coli*
EPEC	Enteropathogenic *E. coli*
ETEC	Enterotoxigenic *E. coli*

FPKM	Fragments Per Kilobase of transcript sequence per Millions base pairs sequenced
g	Gram
GO	Gene Ontology
H’	Shannon diversity index
HUS	haemolytic uremic syndrome
IMD	Immune deficiency pathway
KAAS	Kegg Automatic Annotation Server
KEGG	Kyoto Encyclopedia of Genes and Genomes
km	kilometre
LDA	Linear Discriminant Analysis
MBI	mucosal barrier injury
MF	Molecular functions
mm	millimetre
mRNA	messenger RNA
MRSA	methicillin-resistant *Staphylococcus aureus*
NCBI	National Centre for Biotechnology Information
NHSN	National Healthcare Safety Network
NMDS	non-metric multidimensional scaling
ONT	Oxford Nanopore Technology
OTU	Operational taxonomic unit
PAST	PAleontological STatistics
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RNA	Ribonucleic acid
rRNA	ribosomal RNA

RSEM	RNA-Seq by Expectation Maximization
sp.	Species
SparCC	Sparse Correlations for Compositional data
TCA	tricarboxylic acid
TMM	Trimmed Mean of M- values
USD	US Dollar
UTI	urinary tract infection

CHAPTER 1

INTRODUCTION

1.1 Study Background

The order Chiroptera is the most widespread mammalian group that can be found on all continents, except for the Antarctic (Schipper et al., 2008). There are more than 1469 species of bats making up one-fifth of the mammals in the world (Simmons & Cirranello, 2023). The evolutionary diversification of bat's dietary is very fascinating, from an insectivorous diet as their ancestral character to a wide range of diets including blood, meat, nectar, fruit and diverse omnivorous mixtures (Gardner et. al., 1977; Egert-Berg et al., 2021; Gual-Suárez & Medellin, 2021). Bats are important to food safety as they play a major role in pollination of Malaysia's important fruits such as durian and controlling the agricultural insect pest (Kunz et al., 2011). It was estimated that up to 25-50% of crops worldwide damaged due to herbivorous arthropods attack (Pimentel et al., 1978; Deutsch et al., 2018; Benjamin et al., 2024). A small brown bat of a 7.9 g (*Myotis lucifugus*) must consume 9.9 grams of insects per night and *Tadarida brasiliensis* may consume up to 70% of its bodyweight in insects at the peak lactation every night (Kunz, 1995a; Kunz et al., 1995b). Therefore, our economy and food security of fruits and crops depended heavily on the ecological service provided by the bats (Maslo et al., 2024).

Due to their diverse feeding strategies, bats are ideal wild animal models to study the relationship between diets and gut microbiome (Li et al., 2018). The diversity of gut bacteria not only plays an important role in the health of the host, but so do the products of gut microbiota (Kamada et al., 2013; Colella et al., 2023). Previous microbiome studies focused on bats revealed that high microbiome diversity is displayed across both insect-based (insectivorous) and plant-based (phytophagous; i.e., both frugivorous and nectarivorous) bats (Li et al., 2018; Karasov et al., 2011; Carrillo-Araujo et al., 2015). Microbiome composition and diversity vary and are impacted by a variety of endogenous and exogenous variables, including geographical origin, age, genetics, food, and the use of prebiotics and antibiotics (Wang et al., 2018; Sadeghi, 2022).

Bats are exceptional in the ability to achieve true flight hence able to travel long distances with a large colony. Together with its long-life span and ability to live on a variety of different ecological niches, these features make bats among the most productive species on earth but have raised the worldwide concern in bats as possible repositories of zoonotic pathogens and vectors as they are exposed to numerous different microorganisms (Calisher et al., 2006; Wong et al., 2007; Whitaker et al., 2009; Wibbelt et al., 2009; Kuzmin et al., 2011; Wang et al., 2011; Castelo-Branco et al., 2023).

As they live near human settlement, and often interact with possible intermediate hosts for pathogen such as livestock, domestic animals, and crops. This may intentionally enable them to transmit pathogenetic bacteria to human (Wood et al., 2012; Veikkolainen

et al., 2014). Some of those are *Salmonella typhi* that caused typhoid fever in human, *Borrelia* sp. and *Bartonella* sp. that caused Potomac horse fever (been found in family Vespertillionidae) and numerous records on the presence of genus *Leptospira* in the renal tubules and urine of the bats (Mühldorfer, 2013).

Apart from pathogenetic bacteria, the gut microbiota is related to the fitness, growth, and diet adaptation of organisms. These microbes helped the host in dietary digestive processes (Savage, 1977; Turnbaugh & Gordon, 2009; Lee & Mazmanien, 2010). Co-evolution is considered a cycle of collective adaptation that is essential to biological diversification between hosts and their intestinal microbiota (Brockhurst & Koskella, 2013). These relationships can be studied by using gut transcriptome as a molecular index of microbiota-responsive traits (Bost, 2018). Transcriptomes of various bat organs and tissues, such as brain, heart, kidney, liver, lung, lymph, spleen, thymus, blood, wing biopsies, and salivary gland, have been sequenced and assembled to study gene expressions related to their unique adaptations (Papenfuss et al., 2012; Shaw et al., 2012; Lei et al., 2014; Phillips et al., 2014; Lee et al., 2015; Huang et al., 2016; Foley et al., 2018; Vandewege et al., 2019; Vandewege et al., 2020).

The feeding choices of bats are a focal point in transcriptome investigations of bats. Phillips et al. (2014) found that *Myotis lucifugus* can metabolise external lipids from their insect diet to fuel their flight activity. Gutiérrez-Guerrero et al. (2020) observed that the blood-feeding bat *Desmodus rotundus* exhibited characteristics related to blood

coagulation. Additionally, the nectar-feeding species *Leptonycteris yerbabuenae*, *L. nivalis*, and *Musonycteris harrisoni* displayed a set of genes that are positively selected and involved in sugar, lipid, and iron metabolism. It is essential to comprehend bat dietary preferences to grasp their ecological significance, since their diverse diets directly impact ecosystem dynamics (Kasso & Balakrishnan, 2013; Vesterinen et al., 2016; Ingala et al., 2021). Investigating gene expression patterns in the gut of insectivorous and frugivorous bats is crucial to identify shared and unique metabolic pathways across dietary groups. Understanding these patterns provides insights into the functional adaptations of bat gut metabolism and potential links to microbiome composition.

Despite the growing interest in bats as important ecological actors and potential zoonotic pathogen reservoirs, there is a significant gap in our understanding of the gut microbiomes and gene expression of bats, particularly in Southeast Asia, with Borneo being a prime example. Existing research has focused primarily on the general microbiome of bats, yet there is limited exploration of how dietary preferences specifically influence gut microbial communities, bacterial functional group, functional gene expression, and their potential role in the transmission of antimicrobial resistance (AMR) and zoonotic pathogens. The lack of studies on how dietary guilds such as insectivorous and phytophagous impact microbial diversity and pathogen profiles is a notable oversight. Additionally, current literature overlooks the functional dynamics of the bat gut microbiota and its relationship to gene expression, a crucial aspect in understanding how bats adapt

metabolically to their varied diets. Investigating these relationships is essential not only for filling the existing research gap but also for understanding how dietary preferences in bats influence their health, their potential as reservoirs for antimicrobial-resistant bacteria, and their role in zoonotic pathogen transmission. This knowledge could have significant implications for both conservation efforts and public health strategies, particularly in regions where human-bat interactions are increasing.

1.2 Problem Statements

Bats exhibit remarkable dietary adaptations that shape their gut microbiota, influencing their health, ecological roles, and potential as reservoirs for zoonotic pathogens. Despite their ecological importance and public health relevance, little is known about the functional dynamics of bat gut microbiota, especially in the biodiverse region of Borneo. Current research has largely overlooked how dietary guilds influence gut microbial communities, the prevalence of antimicrobial resistance, and transcriptomic adaptations in bats. Beyond the constraint of inadequate knowledge, this study is also driven by the need to bridge methodological gaps in microbiome and transcriptome research on bats. Most studies have relied on broad taxonomic profiling without integrating functional analyses, limiting our understanding of how microbial communities interact with host metabolism and immune responses. Addressing these gaps will provide a more comprehensive understanding

of how dietary adaptations shape gut microbiota and gene expression in bats, with implications for conservation, ecosystem health, and zoonotic disease surveillance.

1.3 Research questions

(1) What are the gut microbes known from bats that are important for their well-being?

(2) Are there any gut microbes from bats of zoonotic potential and does it have antimicrobial resistance (AMR) properties?

(3) Do different dietary preferences influence the gene expression of the gut microbiomes?

1.1 Hypotheses

(1) Different bat species with varying diets will show distinct gut microbiome compositions.

(2) Bats with diets that include a variety of food sources (e.g., fruit, insects, nectar) will harbor distinct pathogen profiles with varying antimicrobial resistance properties.

(3) Gene expression profiles in the gut will vary based on the type of diet, correlating with metabolic processes required for digestion and ecological adaptation.

1.4 Objectives

(1) To characterize the core bacterial community in the guts of bats with different feeding strategies.

(2) To identify the presence of any pathogenic bacteria in the gastrointestinal tract of the bats and assess their antimicrobial properties.

(3) To identify the gene expressions of small intestine expressed in different bats with varied diet preferences.

CHAPTER 2

LITERATURE REVIEWS

2.1 Bats

Chiroptera is categorised as the second most specious group after the order Rodentia (Glover & Altringham, 2008). Bats can disperse all over the world due to their ability to fly, different feeding guilds, roosting practices, social behavior, and reproductive strategies. There are more than 1300 species of bats (Order Chiroptera) in the world making up one-fifth of the mammals in the world (Tsang et al., 2016).

Borneo is home to a highly diverse assemblage of bats, representing several families, including Pteropodidae, Vespertilionidae, Rhinolophidae, Hipposideridae, Emballonuridae, and Molossidae, totalling up to at least 98 species (Payne et al., 1998; Phillips & Phillips, 2016; Morni et al., 2018). These families exhibit distinct morphological and ecological adaptations, allowing them to occupy a wide range of habitats across the island. Bats in Borneo are distributed across lowland rainforests, montane forests, limestone caves, peat swamps, and even agricultural landscapes (Kumaran et al., 2011; Rajasegaran et al., 2018; Mohd-Azlan et al., 2019). Notably, Borneo hosts several endemic bat species such as *Hipposideros coxi* and *H. dyacorum*, underscoring the island's significance in regional biodiversity (Jinggong et al., 2022; Mahyudin et al., 2022).

Bats are highly dependent on our tropical rainforest as they provide essential

ecological relationships. They pollinate plants, disperse seeds, and regulate the population of insects where all these operations contribute to forest regeneration and dynamics of the environment (Charles-Dominique, 1991; Calisher et al. 2006). They can do this most effectively by selectively feeding prey which delivers high energy per unit effort as bats uses expensive locomotive strategies as well as high reproductive and thermo-regulatory costs (Winter & von Helversen, 1998). In fact, the biophysical conditions of flight hinder bats so they have limits on how much food they can eat and how flexibly they can take decisions on prey (Aldridge & Brigham, 1988). Bats exhibit among the broadest range of food preferences to meet energy-efficient needs within these limits (Altringham, 1996).

Bats is one of the most important ecological service providers in the world. They are the one that control the insect populations and act as pollinators for fruits and trees. The cave nectar bats (*Eonycteris spelaea*) is one of the essential pollinators of tropical flowering trees including durian (*Durio* spp.) and petai (*Parkia speciose*) (Fujita & Tuttle, 1991; Bumrungsri et al., 2009; Aziz et. al., 2017). Besides pollination, bats had been documented as important seed dispersal agent. Old-world fruit bats (Pteropodidae) typically have just eaten the smallest seeds (< 2–3 mm in diameter) and defecated, while larger ones are brought in the whole fruit to the nearest feeder for processing (Corlett, 1998).

Feeding roosts in the genus *Cynopterus* are usually < 80 meters away from the fruit tree (Funakoshi & Zubaid, 1997, Reiter et al. 2006), but daily maximum distances seem to be between 100–200 meters (Tang et al. 2007) but theoretically much greater (Corlett,

2009). Most fruit-swallowed seeds are defecated within 30 minutes, but viable seeds are kept from the last supper until the following night (Shilton et al., 1999).

Total lengths of routine dispersal are limited to the daily flight routines. In many canopy bats, these are more than 1 km but in sub canopy species such as *Balionycteris maculata* are likely to be less than 1 km (Hodgkison et al. 2003). Since the successful pollination and seed dispersal of tropical trees depends on fruit bats, protecting the populations of fruit bat is important for securing the healthy ecosystem of the forest (Bumrungsri et al., 2009; Corlett, 2009).

Insectivorous bats are important predators of the nocturnal insects and are responsible for managing populations of agricultural and forest pests (Kalka et. al., 2008, Boyles et al. 2011; Kunz et al., 2011; Williams-Guillén et al., 2016). In one night, an individual of insectivorous bats could consume up to one third of its body mass thus contributing to estimated USD 59 – USD 139 per hectare of ecosystem service annually in controlling macadamia nuts insect pest in South Africa (Weier et al., 2019). Wrinkle-lipped bats (*Tadarida plicata*) feed on planthoppers that are major rice crop pests in Thailand and a population of 2.6 million individuals has been reported to eat about 17.5 tons of insects during the night (Leelaipaibul et al. 2005). The economic value of this operation has been measured at USD 1.2 million annually (Wanger et al., 2014).

2.2 Bat's gut microbiome

The study of bat microbiomes, particularly their gastrointestinal systems, has gained increasing attention due to their diverse ecological roles and unique biology. Bats, one of the most species-rich mammalian orders, harbor complex gut microbiotas that play essential roles in digestion, metabolism, and immune regulation (Wilson & Reeder, 2015; Zhang et al., 2018). The gut microbiota is fundamental to animal health, influencing energy extraction from food, nutrient synthesis, and defense against pathogens (Dunn et al., 2020; Rothschild et al., 2018). Given that bats serve as natural reservoirs for several zoonotic diseases, their microbiomes may contribute to pathogen resistance, making their study particularly relevant for conservation biology and public health (Virk et al., 2019; Amato et al., 2015).

Diet is a primary factor shaping bat gut microbiomes, influencing microbial composition and function. Insectivorous bats, which rely on a protein- and chitin-rich diet, host microbiota dominated by Firmicutes and Bacteroidetes, which facilitate the digestion of insect exoskeletons and proteins (Rothschild et al., 2018; Zhang et al., 2020). These bats exhibit high levels of chitinase-producing bacteria, aiding in the breakdown of tough insect materials (Dunn et al., 2020). In contrast, frugivorous bats consume fiber- and sugar-rich diets, leading to microbiomes enriched with Firmicutes, Proteobacteria, and Bacteroidetes, which assist in fermenting plant material and extracting energy from complex carbohydrates (Amato et al., 2015; Wilson & Reeder, 2015). Fermentative bacteria such as *Lactobacillus*,

Prevotella, and *Bacteroides* are more prevalent in these species, supporting their dietary specialization (Zhang et al., 2020; Virk et al., 2019). Nectarivorous bats, dependent on simple sugars, often have reduced microbial diversity but a high prevalence of *Lactobacillus* species, which aid in sugar metabolism (Dunn et al., 2020). While the current study does not include blood-feeding bats, studies suggest that sanguivorous species have microbiota adapted to processing iron-rich diets and preventing pathogen overgrowth (Zhang et al., 2018).

Bats, like other mammals, rely on their gut microbiomes to process nutrients that their own digestive systems cannot break down efficiently. Insectivorous bats depend on microbial chitinase and proteases to digest insect exoskeletons, while frugivorous bats rely on fermentation by gut bacteria to produce short-chain fatty acids (SCFAs) such as acetate, butyrate, and propionate (Wilson & Reeder, 2015; Amato et al., 2015). These SCFAs serve as alternative energy sources, enhancing energy balance in bats that experience seasonal fluctuations in food availability (Rothschild et al., 2018; Dunn et al., 2020). Moreover, the presence of fiber-digesting bacteria in frugivorous bats underscores the co-evolution of microbiota with dietary niches. The ability of gut microbes to break down plant polysaccharides contributes to efficient nutrient absorption, which is essential for sustaining bats that rely solely on fruit-based diets (Zhang et al., 2020).

One of the most intriguing aspects of bat microbiomes is their potential role in pathogen resistance. Bats are natural reservoirs for numerous zoonotic viruses, including coronaviruses (SARS-CoV-2), filoviruses (Ebola), and lyssaviruses (Rabies), yet they often remain asymptomatic (Virk et al., 2019; Dunn et al., 2020). Research suggests that gut microbiota may contribute to this resistance through immune modulation and competitive exclusion of pathogens (Amato et al., 2015; Zhang et al., 2020). Certain bacterial genera, such as Lactobacillus and Bifidobacterium, have been associated with enhanced immune function and antimicrobial activity. These bacteria may help prevent the colonization of harmful pathogens by producing antimicrobial peptides and competing for gut resources (Wilson & Reeder, 2015; Rothschild et al., 2018). Additionally, bats with stable and diverse microbiomes may be better equipped to tolerate environmental stressors and reduce pathogen spillover risks (Dunn et al., 2020).

Beyond diet, environmental factors such as habitat type, climate, and geographical location significantly influence bat gut microbiomes. Studies show that bats from different habitats, including tropical forests and urbanized areas, exhibit distinct microbial compositions (Zhang et al., 2020; Amato et al., 2015). Variability in bacterial taxa abundance often correlates with food resource availability and exposure to environmental microbes (Rothschild et al., 2018; Virk et al., 2019). Human activities, such as deforestation and urbanization, may disrupt bat microbiomes by altering their diets and increasing exposure to anthropogenic pathogens. Understanding these ecological influences is essential

for assessing how habitat changes impact bat health and zoonotic disease dynamics (Dunn et al., 2020).

The bat gut microbiome plays a critical role in digestion, nutrient acquisition, immune function, and pathogen resistance. Given the ecological importance of bats and their role in zoonotic disease transmission, microbiome research has significant implications for conservation and public health (Virk et al., 2019; Zhang et al., 2020). Bats with well-balanced microbiomes may be better suited to withstand environmental stressors, resist pathogens, and adapt to changing habitats. Future research should focus on the functional aspects of bat microbiomes, particularly their interactions with host immunity and their role in pathogen suppression. Metagenomic and metabolomic studies can provide deeper insights into microbial community functions and their impact on bat health and disease transmission (Dunn et al., 2020; Rothschild et al., 2018). A better understanding of these dynamics could inform conservation strategies and public health interventions aimed at mitigating zoonotic risks while preserving bat populations.

2.3 Bats as a potential reservoir of pathogens

Bats can be unintentionally harmful to animals. Indeed, they are natural reservoir hosts and sources of infection for several micro-organisms, including pathogens that can trigger severe human illnesses, and are more frequently involved in emergencies involving

zoonotic viruses (Calisher et al., 2006; Brook et. al., 2015). Bats are typical in metropolitan regions and come in close touch with both domestic animals and humans, contaminating homes with guano and urine, as well as people sometimes (Allocati et al., 2016). Bats can convey infectious agents to animals via intermediate hosts in close touch with humans (Hayman et. al. 2013).

Frugivorous bats cannot ingest large quantities of meat due to flight aerodynamics, so they remove nutrients by sucking fruits and sucking seeds. This partly digested food that has fallen on the floor can then be ingested by other livestock and is a prospective cause of infection (Dobson, 2005). Bats can also immediately infect humans through ingestion of infected bat meat, as bats are a food source in some areas, or through a bat bite as in the event of rabies disease (Han, 2015). Other characteristics of the lives of bat create them a great host for infectious agents. One of these is the reality that bats live more than 30 years, unlike many other tiny mammals. Their long life makes them a significant pathogens reservoir and gives them numerous opportunities to transmit them to other species (Krauel & McCracken, 2013).

Additionally, some bats species migrate for distances of more than 1000 km, thus allowing them to spread disease in large areas and acquire new microorganisms (McGuire et al. 2013). Lastly, most pathogens are not dangerous for bats and therefore, survive in the host for a long time without killing them. Indeed, despite the reality that humans are infected with more distinct zoonotic bacteria per host except for rabies virus and other

lyssaviruses which these are not pathogenic to them, implying that bacterial reproduction can be controlled more effectively than other animals. It has been hypothesized that there may be a relationship between flight and low virulence (O'Shea et. al. 2014). During the flight, bats show an increase in metabolic rate and body temperature, comparable to fever response, resulting in less favorable replication of infectious agents sensitive to temperature.

Bacteriological studies in bats are largely confined by the gastrointestinal flora, serology, microscopic identification by genetic techniques from the blood and ectoparasite specimens due to limited sample collection as well as preservation limits (Schwan et al. 2009; Zetun et al. 2009; D'Auria et al. 2010; Kosoy et al. 2010).

Bats have also been implicated in the transmission of several high-profile zoonotic viruses, each with significant public health impacts. Ebola Virus has been one of the most notorious zoonotic viruses associated with bats (Almuqrin et al., 2021; Liu et al., 2024; Riesle-Sbarbaro et al., 2024). Studies have shown that bats, particularly species in the family Pteropodidae, are implicated in the transmission of Ebola virus, where they act as potential reservoirs without necessarily showing symptoms of the disease (Olivero et al., 2020; Sundaram et al., 2024). Evidence suggests that fruit bats harbor the virus in their tissues and can spread it to humans and other animals, causing periodic outbreaks (Calisher et al., 2006; Ruiz-Aravena et al., 2022). The capacity of these bats to harbor the virus without showing symptoms complicates control efforts and poses a significant public health

risk.

SARS-CoV and SARS-CoV-2 are both coronaviruses that have been linked to bats as their original hosts (Kaplan, 2020; Guo et al., 2021; Wu et al., 2021) . SARS-CoV, responsible for the Severe Acute Respiratory Syndrome (SARS) outbreak in 2002–2003, was found to be closely related to bat coronaviruses, particularly RaTG13, a virus isolated from horseshoe bats in China (Geng & Zhou, 2021; Wu et al., 2021) . The SARS-CoV-2, the virus responsible for the COVID-19 pandemic, has shown genetic similarities to bat coronaviruses, further confirming bats as potential natural reservoirs of these viruses (Kaplan, 2020; Guo et al., 2021). These findings have raised concerns about the role of bats in the emergence of new zoonotic diseases, especially in densely populated areas with high bat-human interactions.

MERS-CoV, another coronavirus, is believed to have bats as its primary reservoir, with camels serving as intermediate hosts that transmit the virus to humans (Mohd et al., 2016; Ramadan & Shaib, 2019). The Middle East Respiratory Syndrome (MERS) was first reported in 2012, and while the virus itself is not directly transmitted from bats to humans, genetic studies have shown a clear connection between bat coronaviruses and the virus responsible for the disease (Mackay & Arden, 2015; Kassahun et al., 2020). As with SARS-CoV and SARS-CoV-2, the discovery that bats are involved in MERS-CoV transmission highlights the critical need for monitoring bat populations as potential reservoirs of emerging infectious diseases.

Nipah Virus and Hendra Virus are both part of the paramyxovirus family directly linked to bats have caused outbreaks in humans and animals (Smith et al., 2000; Chong et al., 2009). Nipah virus, which originated from fruit bats, can be transmitted to humans via intermediate hosts like pigs, with fatal consequences (Halpin et al., 2000; Chong et al., 2009). Outbreaks of Nipah virus in Malaysia have led to high mortality rates in both humans and livestock (Yob et al., 2001; Epstein et al., 2006). Similarly, Hendra virus, which is also carried by bats, has caused fatal respiratory and neurological illness in horses and humans, further highlighting the risk posed by bats as hosts of potentially lethal zoonotic agents (Williamson et al., 1998; Halpin et al., 2000; Smith et al., 2011).

Each of these viruses underscores the role of bats in the transmission of zoonotic diseases, many of which have significant implications for public health. The ability of bats to act as natural reservoirs, often without showing symptoms of infection, complicates efforts to predict and prevent future outbreaks. Understanding these dynamics is crucial for developing strategies to mitigate the risks posed by bats as hosts of zoonotic pathogens.

2.4 Bat's bacterial pathogens

The bats bacterial pathogens reviews (e.g. Kuzmin et al., 2011; Lagadec et al., 2012; Mühldorfer, 2012; Mateus et al., 2019; Yuan et al., 2019) gives an overview of information available on bacteria isolated from bats with a focus on the main bacterial pathogens that

can cause disease in bats and humans. Some of the main common pathogenetic bacteria are as follows.

Enterobacteriaceae **–** Most information on healthy human gastrointestinal flora and the presence or absence of bacterial enteropathogens are obtained from traditional microbiological studies (e.g. Gordon and FitzGibbon, 1999; Di Bella et al. 2003; Adesiyun et al. 2009). Most of these studies have so far concentrated on bacterial species that may present potential hazards to human or natural animals (e.g. Arata et al. 1968; Adesiyun et al. 2009; Reyes et al. 2011).

Enteric pathogens such as *Escherichia coli*, *Salmonella*, *Shigella*, *Yersinia* and *Campylobacter* were found in bats. Salmonellosis is an important cause of human and animal gastroenteritis, a bacterial disease of interest for public health and economic importance in cattle (Brenner et al. 2000; Sanchez et al. 2002; Foley & Lynne, 2008). Livestock and wild bird species are considered a reservoir of human-pathogenic *Salmonella* serotypes (Sanchez et al. 2002; Tizard, 2004).

Salmonella however colonizes many domestic and wild livestock, harbouring their organs without clear clinical signs (Sanchez et al., 2002; Hoelzer et al., 2011). Several *Salmonella* serotypes were segregated from clearly healthy as well as diseased bats. Most are broad-host serotypes (Hoelzer et al., 2011). Specifically, *Salmonella* Enteritidis and *Salmonella* Typhimurium were frequently acknowledged, belonging to a small cluster of

Salmonella serotypes mainly linked to human and animal disease (Sanchez et al., 2002; Foley & Lynne, 2008; Hoelzer et al., 2011).

Both serotypes have been isolated from the inner organs of three Vespertilionidae family clusters found killed or severely injured near human homes (Mühldorfer et al. 2011). *Salmonella* serotypes Anatum, Blockley, Rubislaw, Saintpaul and Sandiego are prevalent to people in cattle and animals (CDC, 2009; Hoelzer et al., 2011). *Salmonella* Caracas and *Salmonella* Llandoff were barely acknowledged from human salmonellosis (CDC, 2009).

In contrast to bat *Salmonella* serotypy, the causative agent of typhoid fever, *Salmonella typhi* is nearly exclusively associated with human disease (Uzzau et al., 2000). Interestingly, this serotype was segregated from Madagascar's 58 *Pteropus rufus* (Brygoo et al., 1971) heart blood, inner bodies, and bile and again evidence of a systemic bacterial disease that could possibly result from stress by catching and handling allegedly *Salmonella typhi*-infected bats.

Shigellosis is a highly contagious disease caused by four *Shigella* species: *S. dysenteriae* (group A), *S. flexneri* (group B), *S. boydii* (group C), *S. sonnei* (group D) (Edwards, 1999; Weir, 2002). The symptoms differ from mild to severe dysentery and are restricted to higher primates. In the faeces of 70 *Myotis myotis* from Poland's natural communities, a study has shown the high incidence of diverse *Yersinia* species in the feces (Ro' zalska et al. 1998).

Most bat-isolated species of *Yersinia* are common and occasionally connected to disease in animals and animals (Shayegani et al. 1986; Bottone et al. 2005). Few bacterial pathogens tests in chiropteran species investigated the presence of *Campylobacter* but mainly failed to extract *Campylobacter* bacteria from bats in multiple living settings (Daffner, 2001; Duignan et al., 2003; Adesiyun et al., 2009). Negative results may show lack of *Campylobacter*-exposed bats (Daffner, 2001; Adesiyun et al. 2009).

For example, these enteropathogens appear to have been an important human-pathogenic reservoir of *Campylobakter* strains (Kapperud & Rosef, 1983), with most insectivors and granivores barely screened to have adverse effects for *Campylobacter* species (Waldenstrom et al. 2002). However, insectivorous bats may acquire bacteria from livestock environments (Rosef et al. 1983; Wales et al. 2010), which may indicate the presence of human-pathogenic *Campylobacter jejuni* species in Dutch vespertilionid specimens (Hazeleger et al., 2010).

A wide variety of extra Gram-negative and Gram-positive bacteria have been isolated from bats often considered intestinal commensals in their diets (Müller et al., 1980; Pinus & Müller, 1980; Cassel-Beraud & Richard, 1988). Also acknowledged as enteropathogenesis, several of these bacterial species (i.e. *Escherichia coli*, *Vibrio* spp. and *Clostridium* spp.) can cause bat disease. E.g. *Clostridium perfringens*. (Hajkova & Pikula, 2007; Mühldorfer et al. 2011).

Arthropod-borne bacterial pathogens - In the blood and bat organ tissues, several *Borrelia* and *Bartonella,* and the causal agent of Potomac horse disease *Neorickettsia risticii* were identified. Most of the infected species appear to be normal, except only two vespertilionid bats (*Pipistrellus* sp. and *Natalus tumidirostris*) with serious *Borrelial spirochetaemia* (Marinkelle & Grose, 1968). Several separate phylogroups showing the existence of several novel *Bartonella* species in bats (Concannon, et al., 2005; Kosoy et al., 2010; Bai et al., 2011; Lin et al., 2012). Bartonellosis is a zoonotic bacterial infection that is developing globally (Eremeeva et al. 2007). *Bartonella* sp. is a Gram-negative bacterium conveyed through hematophageal arthropod vectors and detected in several mammalian species such as bats, domestic cattle and wild rodents (Bai et al. 2011; Veikkolainen et al. 2014; Lei and Olival, 2014). Previously, two species of *Bartonella* (*B. mayotimonensis* and *B. naantaliensis*) were discovered in both in the peripheral blood of fruit bats and their ectoparasites in Madagascar. This indicates possible transmission of zoonotic pathogen through the bat fly vector (Veikkolainen et al. 2014; Brook et al. 2015).

In arthropod-borne diseases host switching and variations in the host specificity of ectoparasites are key factors that increase the spread of pathogenic microorganisms (Kampen, 2009). Bats may also bring the bacteria in their blood system (Marinkelle & Grose, 1968; Gibson et al., 2005; Kosoy et al., 2010; Bai et al., 2011), allowing the bacteria to join local communities of ectoparasites at other roosting locations. Most of these bats are in the Vespertilionidae and Molossidae genera suggesting that insectivorous bats are

subjected to the human-pathogenic species of *Borrelia*, *Orienta* and *Rickettsia*. A novel spirochete discovered in a United Kingdom pipistrel bat has also been discovered to have a close relationship with the renowned human pathogenic *Borrelia* species of the repetitive flu category (Evans et al., 2009).

Other bacterial pathogens detected from bats - *Pasteurella* spp. – *Pasteurella* is frequently distributed among livestock as the portion of the normal oral, rheumatic, and upper respiratory tract microbiota. This genus includes opportunistic pathogenic species that can trigger endemic disease, and that are linked with epizootic outbreaks (Wilson & Ho, 2013). Various *Pasteurella* species (primarily *P. multocida*) have been recognized as the primary pathogens of several localized and systemic diseases in bats (Mühldorfer et al. 2011, 2013). The primary cause of diseases appears to be injuries induced by household predators' bites. The latest research in Wisconsin, however, for the first moment in the United States recorded an epidemic of *P. multocida* chronic pasteurellosis in wild bats without related severe injury (Blehert et al. 2014).

***Leptospira* spp.** –*Leptospira* genus includes saprophytic, medium, and pathogenic species which can survive in humid and hot conditions (Monahan et al., 2009). The bacteria colonize their host's kidney tubules and are excreted into the atmosphere by urine (Adler & Moctezuma, 2010).

The existence of *Leptospira* in bats has been proved in several studies (Mühldorfer, 2013; Lagadec et al. 2012; Dietrich et al. 2015). Incidence of leptospiral diseases in

mammals ranged between almost 2% and 35% based on the sample size of the research. Species-specific differences in the levels of bacterial infection may suggest that some bat species are more prone to *Leptospira* (Cox et al., 2005; Matthias et al., 2005; Bessa et al., 2010).

Habitat preference and geographical origin are variables which can affect *Leptospira* colonization in bats. In specific, the infection levels of pathogenic *Leptospira* species have been greater in the wild animal population as compared to the animals collected in urban areas (Fennestad & Borg-Petersen, 1972; Matthias et al., 2005; Bessa et al., 2010).

Bacteria with antibiotic resistance - Antimicrobial resistance (AMR) in wildlife, particularly bats, has emerged as a significant concern, especially with the increasing global awareness of zoonotic disease transmission. Bats, recognized as critical mediators in zoonotic infectious disease spillover, have been identified as potential carriers of antimicrobial-resistant bacteria (Devnath et al., 2022). As the COVID-19 pandemic and other disease outbreaks, such as SARS and Ebola have highlighted the role of bats in the transmission of zoonotic pathogens, the role of AMR in these organisms has become an important area of study. However, knowledge regarding AMR in bats, especially how these bacteria spread between bats and humans, remains limited, and the variability in AMR prevalence based on geographic location, bat species, and study time further complicates the picture (Devnath et al., 2022).

Studies have consistently shown that bats are hosts to a variety of antimicrobial-resistant bacteria, including multi-drug resistant strains, which pose a significant risk to both wildlife and human health (Devnath et al., 2022; Gaeta et al., 2022). Notably, the presence of Methicillin-resistant *Staphylococcus aureus* (MRSA), Extended-spectrum beta-lactamase (ESBL) producing bacteria, and Colistin-resistant Enterobacterales in bats raises alarm, as these pathogens are also prevalent in humans and domestic animals (Devnath et al., 2022).

In addition to the studies on AMR in bats, research on the microbial communities found in bat skin and other body compartments has provided insight into the diversity of antimicrobial-resistant species present. Gaeta et al. (2022) found that a significant percentage of bat skin swabs collected across different regions in Brazil were positive for Staphylococcaceae, a family of bacteria that includes several clinically important species, such as Methicillin-resistant *Staphylococcus aureus* (MRSA). These bacteria were commonly found in bats from rural areas and during the summer months, with most of the strains showing resistance to at least one antibiotic. These findings underscore the importance of understanding the role of bats as reservoirs for antimicrobial-resistant bacteria, which can contribute to the spread of AMR in the environment (Gaeta et al., 2022).

Federichi et al. (2022) also emphasize the increasing concern of bats transmitting resistant bacteria due to their close interactions with humans, particularly in urbanized areas. As flying mammals, bats are highly mobile and are increasingly encountering human

populations, which enhances the potential for zoonotic transmission of AMR pathogens. These interactions, combined with habitat destruction and environmental pollution, have led to an increased risk of AMR spread from bats to humans. Garces et al. (2022) further illustrate the role of bats as both reservoirs and vectors of antimicrobial-resistant bacteria. Their ability to live in diverse ecological niches and interact with both wildlife and humans makes bats a significant player in the global spread of AMR.

In pathogenic and opportunistic bacteria, antimicrobial resistance is of growing interest in human and veterinary medicine. Despite the lack of specific antibiotic therapies, antimicrobial-resistant organisms have been found in wildlife, including bats, and this incidence is almost certainly related to the use of antibiotics in humans and cattle (Rahuma et al., 2005; Costa et al., 2008; Molina-Lopez et al., 2011). As bats frequent urban and rural areas, they may acquire antimicrobial-resistant bacteria from various environmental sources such as insects and soil. These bacteria could then serve as reservoirs of antibiotic resistance genes, which can contribute to the spread of AMR. However, despite growing interest in AMR in wildlife, data on bats remain scarce.

Studies by Souza et al. (1999) found that strains of *Escherichia coli* from bats in Mexico and South America exhibited high levels of resistance to common antibiotics like neomycin, ampicillin, and streptomycin. This finding is in line with other studies that have identified antimicrobial-resistant E. coli strains in bats from Trinidad, with resistance to antibiotics such as streptomycin (26.5%) and tetracycline (16.3%) (Sauza et al., 1999).

However, a study on Australian bats found lower overall incidence of resistant E. coli strains (9.6%), although resistance to spectinomycin was notable (55.2%) (Souza et al., 1999; Sherley et al., 2000).

Sherley et al. (2000) discovered that the prevalence of antimicrobial resistance among Enterobacteriaceae isolates in bats and other wild animals in Australia followed a host- and location-dependent pattern. These findings suggest that bats, along with other wildlife such as rodents, may share common models of antimicrobial resistance, further highlighting the importance of understanding the ecological and environmental factors contributing to AMR spread. Notably, the detection of Methicillin-resistant Staphylococcus aureus (MRSA) from a bat injury in Germany underscores the possibility that resistant pathogens can be transferred to animals, suggesting that bats play a role in the dissemination of resistant bacteria in the environment (Walther et al., 2008).

In conclusion, the growing body of literature on AMR in bats evident for a concerning picture of the potential risks these animals pose to human health and ecological balance. While more research is needed to understand the full scope of AMR in bats, current studies underscore the importance of monitoring bat populations for antimicrobial-resistant pathogens, improving our understanding of the transmission dynamics, and taking proactive measures to limit the spread of AMR from wildlife to humans. The identification of these pathogens in bats not only emphasizes the need for greater surveillance of zoonotic diseases but also calls for urgent action to address the broader public health implications of

antimicrobial resistance. Apart from pathogenetic bacterial, the gut microbiome also consists of beneficial bacteria that could be beneficial to the host. The role of those bacteria can be studied by utilizing the transcriptomic analyses.

2.5 Transcriptomic analyses of gut microbiota

Recent studies on bat gut transcriptomics have provided critical insights into the molecular adaptations that enable bats to thrive on diverse diets, ranging from insects to fruits. These transcriptomic analyses are particularly important in understanding how diet, metabolism, and immune responses co-evolve in these unique mammals. One of the significant studies in this area is by Levinger et al. (2023), who utilized spatial and single-cell transcriptomics to explore the molecular mechanisms underlying immune responses and dietary adaptations in the Egyptian fruit bat (*Rousettus aegypticus*). This research provided detailed maps of bat gut, lung, and blood cells, comparing them to human and mouse cells. The study revealed important divergences in genetic programs related to immune function and environmental interactions. Notably, the Egyptian fruit bat's gut cells, especially enterocytes in the villus tip, expressed evolutionarily young genes that are not typically associated with nutrient absorption. This finding suggested a unique mechanism of dietary adaptation in bats that differs from other mammals, where immune genes were also found to exhibit rapid coding-sequence evolution. These insights into the transcriptional dynamics of bat tissues contribute to a better understanding of bat immunity and their tolerance to lethal viruses, which is a key feature of their evolution (Levinger et al., 2023).

In addition to immune adaptations, transcriptomic studies have also provided valuable insights into the metabolic adjustments in insectivorous bats. Phillips et al. (2014)

conducted a study on the salivary gland transcriptome of the little brown bat (*Myotis lucifugus*), focusing on its adaptation to an insectivorous diet. They identified several genes in the bat's salivary gland, many of which were associated with lipid metabolism, lipid hydrolysis, and insulin resistance—processes that are crucial for energy acquisition and metabolism during insectivory. For example, the gene *CEL* encodes a lipase that hydrolyzes lipophorins from insects, which are then absorbed across the gastric mucosa. These adaptations are critical to maintaining high-energy flight metabolism while foraging for insects. The study emphasized that gene duplication and recruitment played significant roles in these adaptations, revealing how bats evolved specific molecular mechanisms to process their insect-based diet and support their energetically demanding flight (Phillips et al., 2014).

Further research by Allio et al. (2022) expanded on the concept of dietary adaptations in mammals by comparing the transcriptomes of salivary glands across several insectivorous species. Although focused on anteaters and pangolins, the study's findings provide important comparative insights into the evolution of digestive enzymes, specifically chitinase. These enzymes are crucial for breaking down the chitinous exoskeletons of insects. In pangolins and anteaters, different chitinase paralogs are expressed in various digestive organs, reflecting divergent evolutionary paths in response to insectivory. This research is particularly relevant to understanding similar adaptations in insectivorous bats, where specific digestive enzymes are crucial for processing insect

exoskeletons and other hard-to-digest dietary components (Allio et al., 2022).

Transcriptomic studies have also begun to explore the gut microbiomes of bats and how they are shaped by dietary habits. Dai et al. (2024) analyzed the gut microbiota of eight insectivorous bat species in southern China, finding that diet had a significant impact on the composition of the gut microbiome. Their research revealed that dietary differences between bat species influenced microbial communities at various taxonomic levels, particularly in response to specific insect consumption. Interestingly, the study also showed that factors such as host species, body size, and geographic variables like latitude and elevation further influenced the gut microbiome, suggesting that multiple factors, including diet, play a role in shaping the gut microbiome of bats. This study emphasizes the importance of the microbiome in the digestive processes of bats and highlights the potential for future transcriptomic investigations to better understand how diet and microbial communities co-evolve in these mammals (Dai et al., 2024).

In conclusion, these reviewed literatures shed a light on the multifaceted nature of bats in as the hosts of zoonotic pathogens, including viruses (coronaviruses) and bacteria (e.g. *Leptospira* and *Bartonella*). The ability of the bats species as the reservoirs for pathogen-linked bacteria and with potential antimicrobial resistance properties, certainly positions them as important subject for zoonotic studies. Transcriptomic studies revealed molecular adaptations that have allowed bats to accommodate their diverse eating habits. These studies influence the interest on exploring the relationships between feeding

strategies, gut microbiota, zoonotic pathogen, and the gene expressions that align with the objectives of this study.

CHAPTER 3

MATERIAL AND METHODS

3.1 Study sites and fecal sample collection

Thirty healthy adult bats with different diets were randomly collected through opportunistic sampling using harp traps and mist nets from eight localities throughout Sarawak, Malaysian Borneo (Figure 3.1). Opportunistic sampling was used so that the species were chosen based on their availability and accessibility during fieldwork rather than pre-defined criteria. This approach allows for maximizing sample collection across different sites and habitats. The samples were then separated into two groups based on diet, as indicated in Table 3.1: 17 for the phytophagous (plant-based diet: frugivorous and nectarivores) group and 13 for the insectivorous (insect-based diet) group. The bats were housed in individual sterilised sacks. Upon defecation, fresh fecal samples were collected using sterilised forceps and transferred into sterilised fecal tube containing 300ul RNAprotect solution (QIAGEN, Germany) for nucleic acid preservation. The workbench was sterilised using 30% bleach solution. The fecal samples then transferred into a -80 °C deep freezer in the laboratory until the DNA extraction procedure. The bats were released after fecal sample collection.

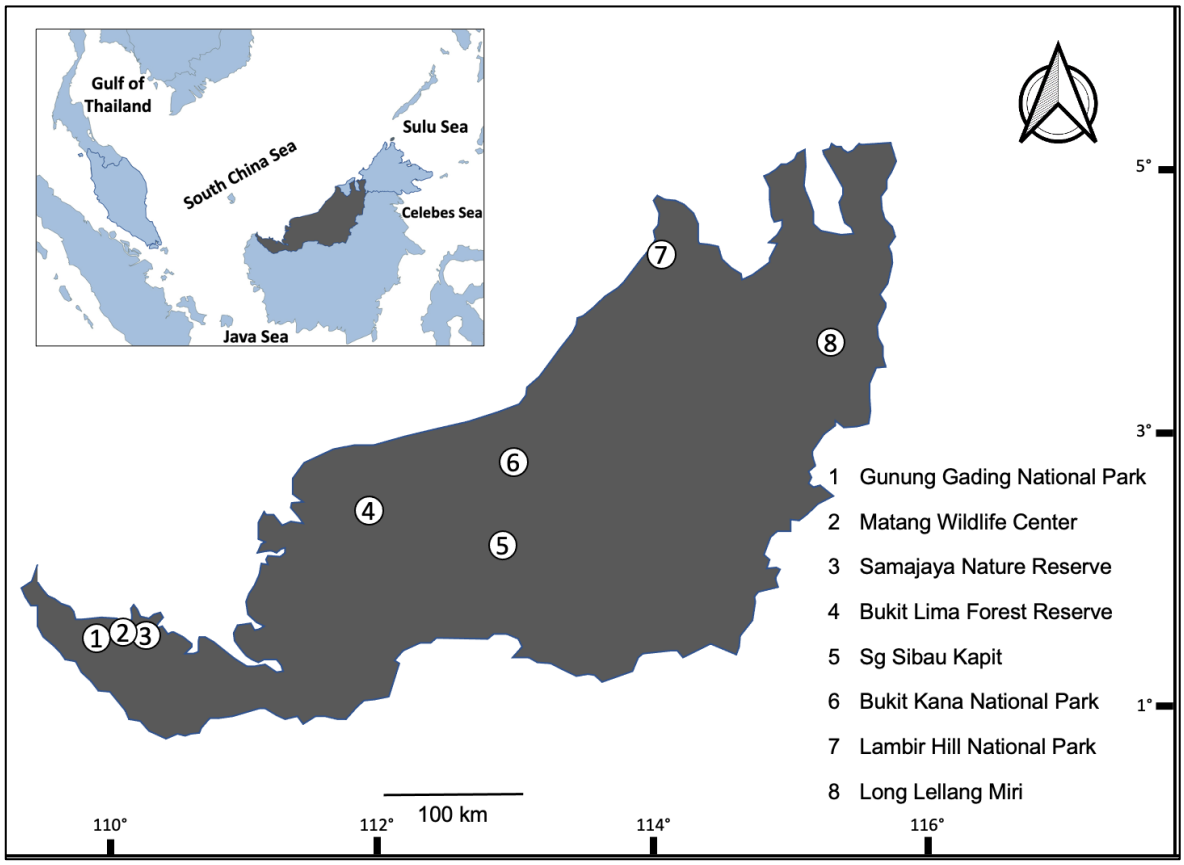


Figure 3.1: Inset map highlighted in grey shows the Malaysian Borneo boundary. Larger map of Malaysian Borneo on the right shows the collection sites of bats fecal sample, labelled from 1 until 8.

Table 3.1: Details on the bat samples used in this study.

Species/ID number	Abbv.	Diet	Locality	Habitat	Gender
Glischropus tylophus	Gtylo	Ins			
GGNP21005	Gtylo[1]		Gunung Gading NP	Peridomestic	♂
GGNP21029	Gtylo[2]		Gunung Gading NP	Peridomestic	♂
LL22016	Gtylo[3]		Long Lellang Miri	Peridomestic	♂
Hipposideros diadema	Hdiad	Ins			
BKNP20055	Hdiad[1]		Bukit Kana NP	Forest	♀
BKNP20090	Hdiad[2]		Bukit Kana NP	Forest	♀

Kerivoula hardwickii	Khard	Ins			
GGNP21015	Khard[1]		Gunung Gading NP	Peridomestic	♀
Kerivoula minuta	Kminu	Ins			
LHNP22009	Kminu[1]		Lambir Hill NP	Forest	♀
Hipposideros ridleyii	Hridl	Ins			
MWC21022	Hridl[1]		Matang WC	Peridomestic	♀
Myotis muricola	Mmuri	Ins			
LL22001	Mmuri[1]		Long Lellang Miri	Peridomestic	♀
Myotis ridleyi	Mridl	Ins			
GGNP21001	Mridl[1]		Gunung Gading NP	Peridomestic	♀
Rhinolophus acuminatus	Racum	Ins			
BKNP20085	Racum[1]		Bukit Kana NP	Forest	♂
Rhinolophus affinis	Raffi	Ins			
MWC21024	Raffi[1]		Matang WC	Forest	♂
Rhinolophus philippinensis	Rphil	Ins			
BKNP20089	Rphil[1]		Bukit Kana NP	Forest	♀
Rhinolophus sedulus	Rsedu	Ins			
BKNP20015	Rsedu[1]		Bukit Kana NP	Forest	♀
LHNP22008	Rsedu[2]		Lambir Hill NP	Forest	♀
Rhinolophus trifoliatus	Rtrif	Ins			
BKNP20081	Rtrif[l]		Bukit Kana NP	Forest	♂
Tylonycteris pachypus	Tpach	Ins			
GGNP21007	Tpach[1]		Gunung Gading NP	Peridomestic	♂
SSK22022	Tpach[2]		Sungai Sibau Kapit	Peridomestic	♂
Tylonycteris robustula	Trobu	Ins			
SSK22024	Trobu[1]		Sungai Sibau Kapit	Peridomestic	♂
Balionycteris maculata	Bmacu	Phy			
BKNP20075	Bmacu[1]		Bukit Kana NP	Forest	♀
BKNP22031	Bmacu[2]		Bukit Kana NP	Forest	♂
BKNP22033	Bmacu[3]		Bukit Kana NP	Forest	♂

MWC21015	Bmacu[4]		Matang WC	Peridomestic	♂
Cynopterus brachyotis	Cbrac	Phy			
BKNP20036	Cbrac[1]		Bukit Kana NP	Forest	♂
BLFR22001	Cbrac[2]		Bukit Lima FR	Peridomestic	♂
SSK22005	Cbrac[3]		Sungai Sibau Kapit	Peridomestic	♂
SSK22002	Cbrac[4]		Sungai Sibau Kapit	Peridomestic	♂
Dyacopteurs spadiceous	Dspad	Phy			
LHNP22010	Dspad[1]		Lambir Hill NP	Forest	♂
Macroglossus minimus	Mmini	Phy			
BKNP20052	Mmini[1]		Bukit Kana NP	Forest	♂
BKNP20077	Mmini[2]		Bukit Kana NP	Forest	♂
BKNP20094	Mmini[3]		Bukit Kana NP	Forest	♂
BKNP20095	Mmini[4]		Bukit Kana NP	Forest	♂
SSK22003	Mmini[5]		Sungai Sibau Kapit	Peridomestic	♂
SSK22004	Mmini[6]		Sungai Sibau Kapit	Peridomestic	♂
Penthetor lucasi	Pluca	Phy			
MWC21017	Pluca[1]		Matang WC	Peridomestic	♂

*Ins=insectivorous, Phy=phytophagous, NP=national park, WC=wildlife center

3.2 DNA extraction, PCR amplification and sequencing

The total genomic DNA for each faecal sample was extracted using the QIAmp PowerFecal Pro DNA (QIAGEN, Germany) (Gel visualization: Figure 3.2). The sequencing was performed inhouse using the MinION Mk1C sequencing platform (Oxford Nanopore Technology, United Kingdom). DNA was amplified using specific barcoded 16S rRNA primers (27F 5'-AGAGTTTGATCCTGGCTCAG-3' and 1492R 5'-GGTTACCTTGTTACGACTT-3') by Polymerase Chain Reaction (PCR) with the following cycling conditions: Initial denaturation 1 min @ 95 °C (1 cycle), denaturation 20 s

@ 95 °C (25 cycles), annealing 30 s @ 55 °C (25 cycles), extension 2 min @ 65 °C(25 cycles), final extension 5 min @ 65 °C (1 cycle) and hold @ 4 °C. The amplified barcoded 16 S rRNA amplicons were approximately 1500 bp in length. All barcoded libraries were pooled to a total of 100 fmoles in 10 ul mM Tris-HCl pH 8.0 with 50 mM NaCl. The DNA library was then mixed with Sequencing Buffer (SQB), Loading Beads (LB), reagent RAP and Nuclease-free water before being loaded into SpotON sample port of the flowcell to begin sequencing. The detailed protocol can be referred in 16 S Barcoding Kit (SQK-RAB204) handbook (Oxford Nanopore Technology, United Kingdom). The entire process was conducted under sterile conditions to prevent any potential contamination.

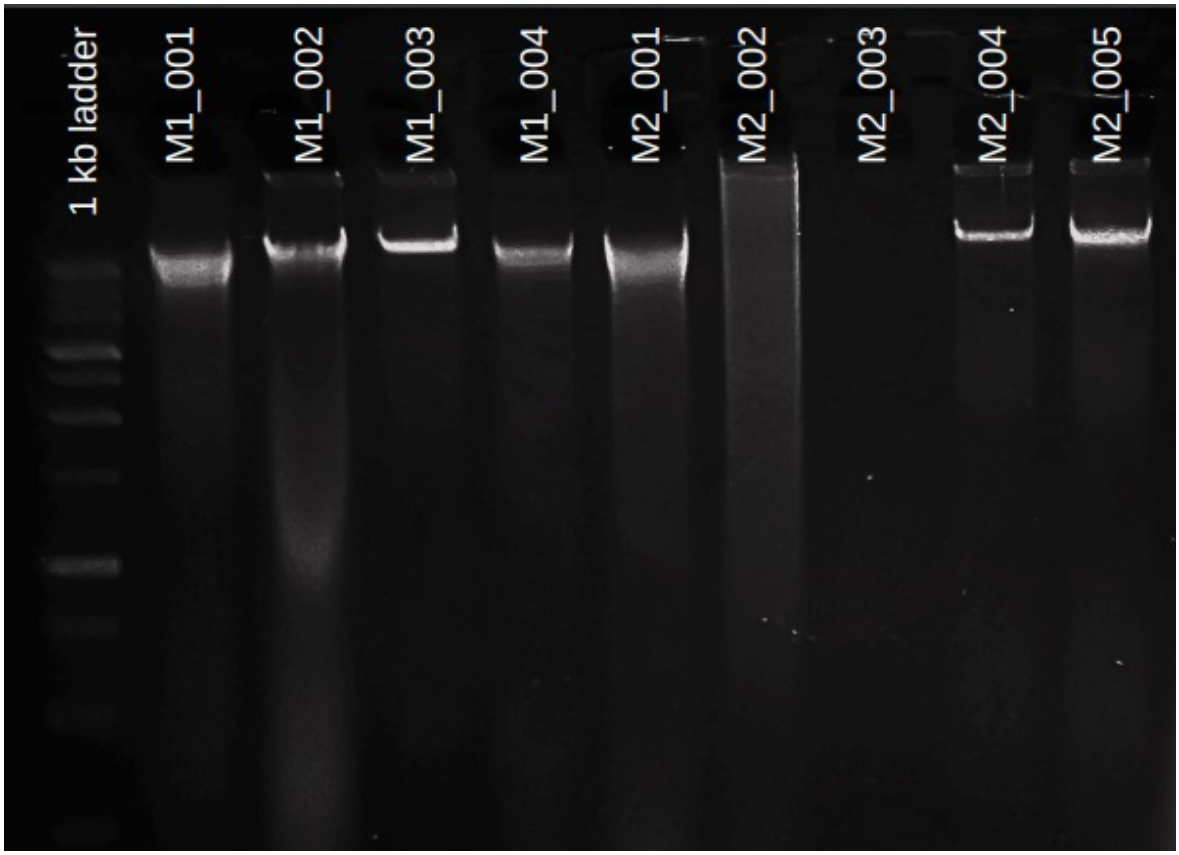


Figure 3.2: The gel visualisation of gDNA products

3.3 Bioinformatic processing

Resulting FASTQ data were imported into the EPI2ME programme (Oxford Nanopore Technology-ONT, Oxford, UK) and processed using the FASTQ 16S procedure. The reads were filtered using the default settings. Reads with a quality score below the threshold (value = 7) were not used in downstream analyses. The minimum coverage required was 30%. The minimum BLAST p_indent was set at 77%, and the maximum number of hits per sequence was three. Only the readings that passed the quality check were used and subjected to BLAST analysis against the NCBI 16S bacterial database. The bacterial species list for each bat individual was retrieved for downstream processes. The bacteria were ranked systematically up to the phylum level using the BacSyst v2.1 (Morni, 2023) programme in RStudio v4.3.1.

3.4 Statistical analysis

Output data from bioinformatic processing were further analysed downstream to generate an operational taxonomic units (OTUs) table, metadata file and taxonomy table. These files were loaded into MicrobiomeAnalyst 2.0 (https://www.microbiomeanalyst.ca/) (Dhariwal et al., 2017; Chong et al., 2020; Lu et al., 2023). The metadata undergone rarefication (Weiss et al., 2017) and several data processing such as producing bacterial relative abundance, good's coverage measure (Li et al., 2018), Sparse Correlations for

Compositional data (SparCC) (Friedman & Alm, 2012; Lee et al., 2017; Matchado et al., 2021), non-metric multidimensional scaling (NMDS) and analysis of similarities (ANOSIM) (Li et al., 2018; Mehl et al., 2021). Statistical analyses of alpha-diversity indices such as dominance (*D*), Simpson (1-*D*), Shannon-Wiener (*H'*) and evenness ($e^{H/S}$) were computed using PAleontological STatistics (PAST) v.4.14 (Hammer et al., 2001; Lombogia et al., 2020). The Functional Annotation of Prokaryotic Taxa (FAPROTAX), a predictive metagenomic tool was used to infer putative functional groups of microbial communities based on taxonomic classifications identified in the samples (Louca et al., 2016; Chen et al., 2021).

3.5 Detection and statistical analysis of pathogenic bacteria

The list of bacteria was loaded into BacPatho v1.2 (Morni, 2023) package in RStudio. This package uses the Pathogen Codes 2022 (updated July 2023) published by the Centers for Disease Control and Prevention, United State Department of Health & Human Service (downloadable link: https://www.cdc.gov/nhsn/xls/master-organism-com-commensals-lists.xlsx) to check for the bacteria's risk category. The dataset was sorted, grouped, analysed and visualised using MS Excel, ggplot2 v3.4.4 (Wickham, 2016), phyloseq v1.41.1 (McMurdie & Holmes, 2013) and Circos Table Viewer (http://mkweb.bcgsc.ca). The significance differences between different physiological and ecological factor (Diet, habitat, family and gender) of the bats towards the bacterial detection were calculated using Kruskal-Wallis test and Mann Whiteney U test. These calculations were done in RStudio, using

kruskal.test, dunn.test and wilcox.test functions. P-value less than 0.05 indicates significant difference between two factors.

3.6 Compiling checklist of common pathogenic bacteria reported in bats

This study used the PRISMA approach (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) to search key databases, including Google Scholar (https://scholar.google.com), ResearchGate (https://www.researchgate.net), and Web of Science (https://www.webofscience.com) to create a database of common pathogenic bacteria reported in bats. The bacteria genus chosen for the search keywords were determined based on the pathogenic bacteria species from preliminary readings and more were added as the literature searching proceeded. The following keywords were used: (bats or bat or microchiroptera or macrochiroptera or chiroptera) AND (bacteria or pathogenic bacteria or common pathogen or *Bartonella* or *Staphylococcus* or *Escherichia* or *Borellia* or *Salmonella* or *Lactococcus* or *Enterococcus* or *Streptococcus* or *Citrobacter* or *Shigella* or *Campylobacter* or *Leptospira*) to search for the literature. Articles in non-English languages and those that do not mention the host species of the bacteria were excluded from the list. In total, 67 literatures were reviewed. Due to vast number of bacteria's species reported within each genus, this study only mentions the bacteria's genus together with information on bats species. This to ensure concise and accurate reporting. The flowchart of the review process is simplified in Figure 3.3.

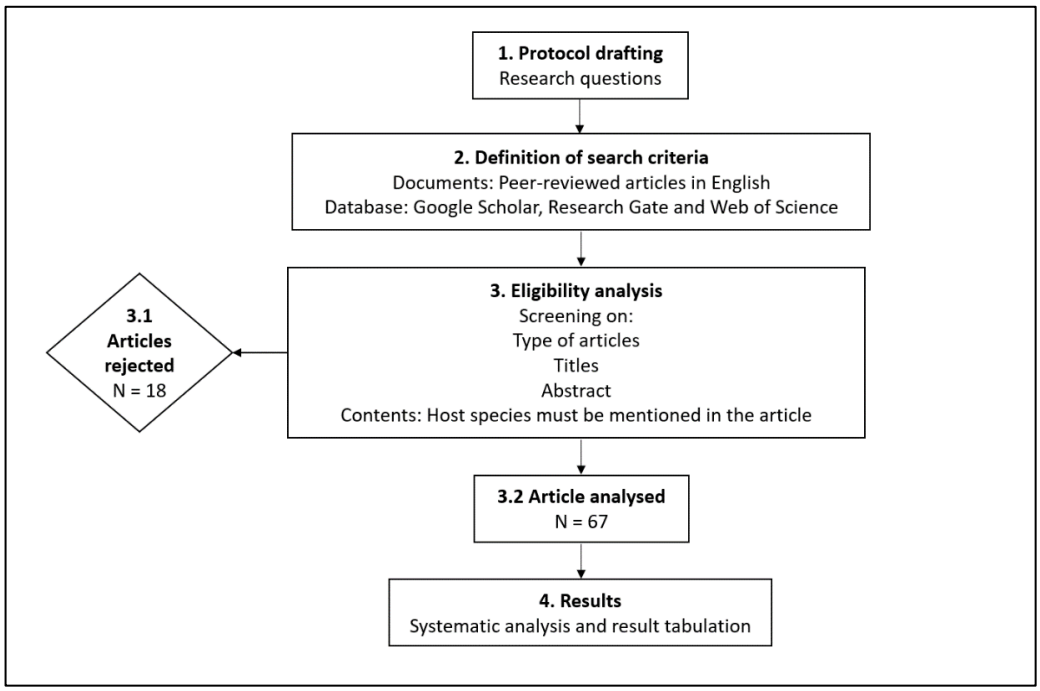


Figure 3.3: The flowchart of the review process

3.7 Antibiotic resistance detection

The presence of the antibiotic resistance gene in the bacterial reads were performed using the EPI2ME platform provided by the ONT. The FASTQ files were uploaded and run through the Fastq Antimicrobial Resistance workflow. The antibiotic-resistance ontology (ARO) and resistance gene sequences were acquired from the Comprehensive Antibiotic Resistance Database (CARD) (http://arpcard.mcMaster.ca/). The ARO defines the relationship between genes and antibiotics. The antibiotic-resistance workflow begins with the standard 1D base calling from Oxford Nanopore Technologies and then aligns the 1D base calls against the complete set of antibiotic-resistance genes in the CARD database using lastal. The report specifies which bacteria, what type of antibiotic affected, and the location of resistance gene mutation that are indicative of antibiotic resistance.

3.8 Sample collection for transcriptomic study

Six individuals of bats from different species of three dietary preferences (fruit; nectar; insect) were collected for this study throughout Borneo (Table 3.2). The selection of six bats from different dietary groups (frugivorous, nectarivorous, and insectivorous) aimed to explore how diet influences gene expression in the small intestine. This sample size allows for an initial exploration of dietary effects while balancing logistical feasibility and ethical considerations. Given the challenges of obtaining bat specimens in the wild and the resources required for molecular analyses, the study was designed to maximize insights within practical constraints. Different diets affect metabolic, cellular, and binding processes, which are crucial for nutrient absorption and gut function. By including multiple species, the study enables comparisons of gene expression patterns across dietary guilds, providing insights into how feeding habits shape intestinal physiology and adaptation in Bornean bats. The bats were trapped using mist-nets and harp traps deployed at their potential flying pathway. Only the bat individual of interest species was kept and housed in an individual cloth bag for further process. Upon euthanisation, a small portion approximately 0.5cm of the small intestine were quickly extracted using sterile blade and forceps, then stored in 1.5ml tube containing RNAlater solution (QIAGEN, Germany). The tubes were stored in -80 °C freezer until the RNA extraction procedure. The bat specimen were kept in 70% ethanol and deposited in UNIMAS Zoological Museum for future educational use.

Table 3.2: List of species collected for transcriptomic study

Species	Code	ID number	Localty	Diet
Cynopterus brachyotis	Cbrac	SSK22-02	Sungai Sibau Kapit	Phytophagous
Penthetor lucasi	Pluca	MWC21-17	Matang WC	Phytophagous
Macroglossus minimus	Mmini	SSK22-04	Sungai Sibau Kapit	Phytophagous
Hipposideros ridleyi	Hridl	MWC21-22	Matang WC	Insectivorous
Rhinolophus affinis	Raffi	MWC21-24	Matang WC	Insectivorous
Tylonycteris pachypus	Tpach	SSK22-22	Sungai Sibau Kapit	Insectivorous

WC-Wildlife Center

3.9 RNA extraction, library construction and sequencing

The total RNA was extracted using RNeasy Kits (QIAGEN, Germany) according to manufacturer's protocol. RNA sequencing was outsourced to Apical Scientific Sdn Bhd and performed on the Illumina platform. The messenger RNA was isolated from total RNA by using poly-T oligo-linked magnetic beads. The first strand cDNA was created using fragmentation, followed by the synthesis of the second strand cDNA using random hexamer primers and dTTP for a non-directional library (Figure 3.4). The library was quantified using Qubit and real-time PCR, and the size distribution was detected using a bioanalyzer. Accurately quantified libraries were combined and sequenced using Illumina platforms, generating paired-end reads. The cDNA of the host was differentiated from those of the bacterial species by cross-referencing sequences against the host genome. Reads that matched the host genome were identified and subsequently discarded.

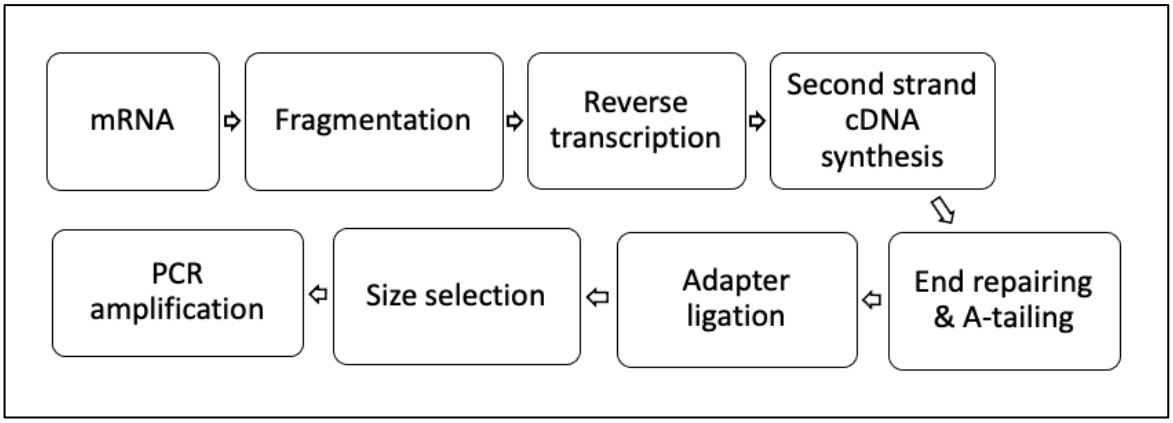


Figure 3.4: The workflow of non-directional library reconstruction

3.10 Gene expression analysis pipeline

Transcriptome reconstruction

Trinity was used for transcriptome assembly. The process may be obtained here: http://trinityrnaseq.github.io. It is a professional transcriptome assembly programme (with components called Inchworm, Chrysalis, and Butterfly). Then, CORSET software (Davidson & Oshlack, 2014) was used to eliminate redundancy from Trinity findings. Hierarchical clustering is based on several mapping events and expression patterns. Finally, BUSCO (benchmarking universal single-copy orthologs) (Simão et al., 2015) was employed to offer a quantitative assessment of transcriptome completeness based on predicted gene content

.

Annotation

To annotate the gene functions, Gene Ontology (GO) and Kyoto Encyclopedia of Genes and Genomes (KEGG) database were utilized with these software and parameters. (1) GO database; Software: Blast2GO (Conesa et al., 2005) and Novogene script platform, Parameters: Threshold of 1e-6. (2) KEGG database; Software: Kegg Automatic Annotation Server (KAAS) (Moriya et al., 2005), Parameters: Threshold of 1e-5.

Quantification and differential expression analysis

Gene expression levels were estimated by RNA-Seq by Expectation Maximization (RSEM) package (Li & Deway, 2011) for each sample as following: (1) Clean data was mapped back to the assembled transcriptome, (2) Readcount of each gene was obtained from the mapping results. Prior to differential gene expression analysis, for each sequenced library, the read counts were adjusted by Trimmed Mean of M- values (TMM) through one scaling normalized factor. Differential expression analysis of two conditions was performed using the edgeR R package (Robinson et al., 2010). The *P*-values were adjusted using the Benjamini and Hochberg methods. Corrected *P*-value of 0.005 and |log2 (Fold Change) | of 1 were set as the threshold for significantly differential expression.

Enrichment analysis

Gene Ontology (GO) (Ashburner et al., 2000) assigns genes to biological processes, molecular activities, and cellular components using a directed acyclic graph structure. This study utilised the clusterProfiler R programme to perform statistical GO enrichment of differentially expressed genes. The GO term with an adjusted P-value of less than 0.05 were regarded significantly enriched. The Kyoto Encyclopaedia of Genes and Genomes (KEGG) (Kanehisa & Goto, 2000) annotates genes by pathway. KEGG is a database resource for understanding high-level functions and utilities of biological systems, such as cells, organisms, and ecosystems, using molecular level information, particularly large-scale molecular datasets generated by genome sequencing and other high-throughput experimental technologies (http://www.genome.jp/kegg/). This study used KOBAS software to investigate the statistical enrichment of differentially expressed genes in KEGG pathways.

CHAPTER 4

GUT MICROBIOME COMMUNITY PROFILING OF BORNEAN BATS WITH DIFFERENT FEEDING GUILDS

4.1 Introduction

Gut microbiome plays crucial roles across many facets of mammalian health. The gut microbiome comprises billions of microorganisms and is one of the most complicated microbial ecosystems (Tremaroli & Bäckhed, 2012; Underhill & Iliev, 2014; Wang et al., 2018). This microbial community plays a crucial role in synergizing with the host to enhance energy storage, maintain functional stability, and promote metabolic balance within the gastrointestinal tract (Sommer et al., 2016; Sonnenburg & Bäckhed, 2016). Some examples of bacteria phylum reported in mammals are Bacteroidota, Campylobacterota, Firmicutes and Proteobacteria (Bermingham et al., 2017; Shin et al., 2015; Waite et al., 2019). The diversity of gut bacteria not only plays an important role in the health of the host, but so do the products of gut microbiota (Kamada et al., 2013; Colella et al., 2023). This includes proteins, small molecular chemicals, and even DNAs. For example, the gut microbiota contributes in a unique way to the variety of bile acids in the bile acid pool (Long et al., 2017; Wahlström et al., 2017). The diverse microbiome is substantially influenced by dietary preference (Bartell, 2006; Sommer et al., 2016; Winglee et al., 2017).

Bats are unique in the terms of their dietary preferences. Their evolutionary diversification is fascinating, from an insectivorous diet as their ancestral character to a wide range of diets including blood, meat, nectar, fruit, and diverse omnivorous mixtures (Gardner et al., 1977). Bats are ranked as the second most specious group of mammals after the order Rodentia (Glover & Altringham, 2008). They are volant and can disperse long distances and display a variety of life history traits, ranging from different feeding guilds and roosting practices to unique social behaviours and reproductive strategies. There are more than 1469 species of bats making up one-fifth of the mammals in the world (Simmons & Cirranello, 2023). Due to their diverse feeding strategies, bats are ideal wild animal models to study the relationship between diets and gut microbiome (Li et al., 2018).

Previous microbiome studies focused on bats revealed that high microbiome diversity is displayed across both insect-based (insectivorous) and plant-based (phytophagous; i.e., both frugivorous and nectarivorous) bats (Li et al., 2018; Karasov et al., 2011; Carrillo-Araujo et al., 2015). Microbiome composition and diversity vary and are impacted by a variety of endogenous and exogenous variables, including geographical origin, age, genetics, food, and the use of prebiotics and antibiotics (Wang et al., 2018). The intestinal bacterial community of insectivorous bats in central-southern Mexico was noted to harbour greater diversity as compared to phytophagous bats from the same area (Carrillo-Araujo et al., 2015). Whereas phytophagous bats in China had a higher microbial diversity than insectivorous species (Li et al., 2018). A metagenomic study of guano deposits in the

Philippines documented composition of Proteobacteria (61.7%), Actinobacteria (19.4%), Bacteroidetes (4.2%), Firmicutes (2.7%), Chloroflexi (2.5%), candidate phylum TM7 (2.3%) and Planctomycetes (1.9%) (Leon et al., 2018).

Although previous studies have explored the microbiome diversity in bats, critical gaps in the literature remain that necessitate further investigation, particularly in the context of Southeast Asia and Borneo. Most prior research has focused on limited geographic regions, such as Central-Southern Mexico, China, and the Philippines (Carrillo-Araujo et al., 2015; Li et al., 2018; Leon et al., 2018). These studies highlight variability in microbiome diversity influenced by diet, geography, and other factors, yet findings cannot be universally generalized due to ecological, environmental, and dietary differences unique to other regions.

Borneo, with its rich biodiversity and unique ecosystem, has not been thoroughly studied in terms of bat microbiomes. Given its position as a biodiversity hotspot, the lack of data on bat microbiome composition within this region represents a significant research gap. Furthermore, dietary influences on microbiome diversity in bats from Southeast Asia, particularly comparing phytophagous and insectivorous species, remain understudied. Recently, high-throughput sequencing methods have become more widely available and cost effective. This enables researchers to conduct more studies on microbiota aimed at demonstrating the connection between a bat's host and its microbiota.

4.2 Results

Analysis of 16S rRNA gene sequencing results

From 17 insectivorous bats and 13 phytophagous bats, a total of 4,201,593 high-quality 16S rRNA sequences were generated. To ensure that differences in sequencing depth across samples did not bias the results, the data were normalized by rarefying the OTU matrix. During the rarefaction process, the OTU table was adjusted such that the total number of sequences in each sample matched the minimum library size. Specifically, sequences were randomly selected from each sample until the total count matched the minimum library size that is 15,048 sequences without replacement. This process minimized biases from uneven sampling depths, ensuring reliable diversity and community composition comparisons across dietary groups (Weiss et al., 2017).

The rarefaction curves of the OTUs found in this study demonstrated an increase in the number of observed species with increasing sequencing depth. As is typical with sequencing data, the ends of the rarefaction curves flattened out as the number of sequences per sample increased (Figure 4.1). Good's Coverage measures how well each sample is covered by the reference database (Li et al., 2018), and in this study, it had a value of 99.6%, meaning that most of the bacterial species in the samples had been identified. The bacteria microbiome was classified into 18 phyla, 43 classes, 100 orders, 210 families, and 1189 genera. The full bacteria species list can be referred to Appendix 1.

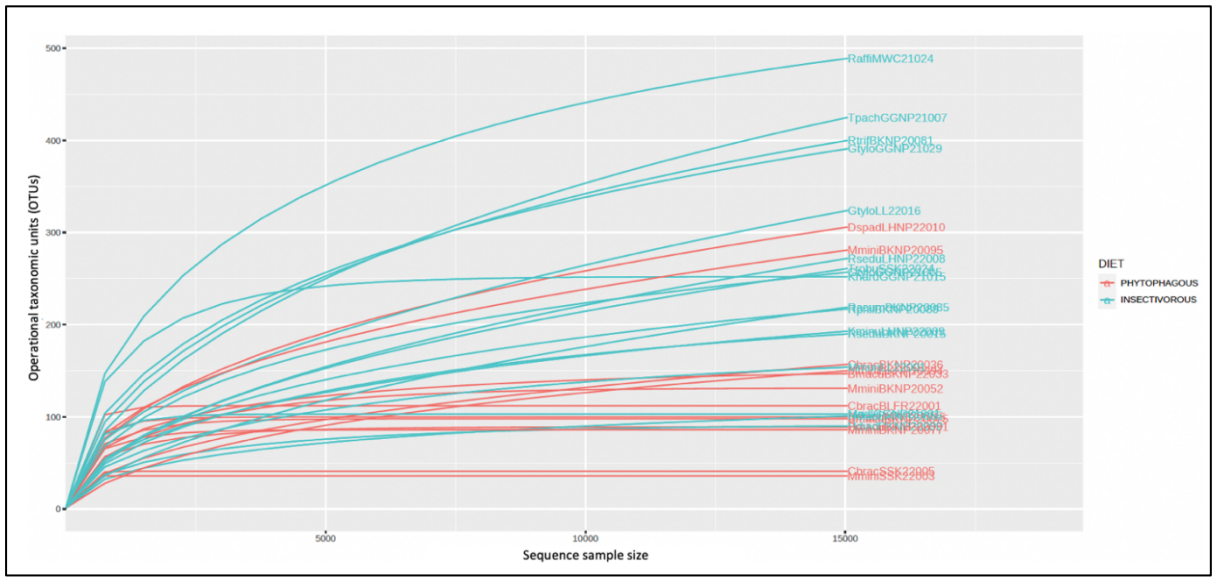


Figure 4.1: The rarefaction curves of OTUs. The x-axis shows the number of valid sequences per sample and the y-axis shows the observed operational taxonomic units (OTUs). Each line in the graph represents one sample. The diet grouping shown through two different colours. Abbreviation follows Table 3.1.

Differences of microbiota diversity between two feeding guilds

Alpha-diversity indices namely dominance (D), Simpson (*1-D*), Shannon-Wiener (*H'*) and Evenness ($e^{H/S}$) were calculated for each feeding groups and interpreted according to Lombogia *et al.,* 2020: (a) dominance – 0 (no dominance), 1 (complete dominance); (b) Simpson (1-D) – 0 (no diversity), 1 (infinite diversity); (c) Shannon – 0 (no diversity), 3 to 4 (high diversity), >4 (very high diversity); (d) evenness – 0 (complete unevenness), 0.1 to 0.3 (low evenness), 0.4 to 0.6 (moderate evenness), 0.7 to 0.9 (high evenness), 1 (perfect

evenness) (Lombogia et al., 2020) (Table 4.1). There is no dominant taxon and no taxa evenness displayed by the bacteria community detected in either group. The Simpson (*1-D*) and Shannon (*H'*) values indicates that both phytophagous and insectivorous bats have a high microbial species diversity. Slightly higher in Simpson (*1-D*) value is the phytophagous bats. There is 92.4% of probability for two individuals of bacteria that picked randomly from phytophagous bats microbiome pool will belong to different species. For insectivorous bats, the probability is 91.5%. The highest Shannon index (*H'*) value belongs to phytophagous bats with 3.423 whereas 3.322 for insectivorous bats. As the number of operational taxonomic units (OTUs) grows and the distribution of individuals across taxonomic groups becomes more even, the value rises (Table 4.1).

The beta diversity analyses were performed with the one-way Analysis of Similarity (ANOSIM) yielded an R-value of 0.54 ($p<0.001$) and the non-metric multidimensional scaling (NMDS) analysis plot shows distinct clustering based on dietary preferences, with minimal overlap between groups (stress value = 0.18) (figure 4.2). The ordination axes (NMDS 1 and NMDS 2) represent variation in the dataset, summarizing differences in bacterial composition based on dietary preference groups. The positioning of points along these axes reflects the degree of similarity among samples: closer points indicate greater similarity, while more distant points represent greater differences. The plot also includes the 0.20 stress value limit, which helps assess the reliability of the ordination, with lower stress values indicating a better representation of the data structure.

These results suggest that the observed differences are driven by diet, rather than individual species variation. The analysis also accounted for species as a factor, and no significant species-specific effects were found to explain the observed differences. Therefore, it can be concluded that the inter-group differences are greater than intra-group differences, which suggests that diet, rather than species composition is the primary factor influencing the bacterial composition variation.

Table 4.1: Table of alpha diversity indices calculated from phytophagous and insectivorous bats. The interpretations are based on Lombogia et al., 2020.

Diet preference	Alpha diversity indices	Value	Interpretation
Phytophagous	Dominance, *D*	0.076±0.000	No dominance
	Simpson, *1-D*	0.924±0.000	High diversity
	Shannon, *H'*	3.423±0.000	High diversity
	Evenness $e^{H/S}$	0.019±0.000	No evenness
Insectivorous	Dominance, *D*	0.085±0.000	No dominance
	Simpson, *1-D*	0.915±0.000	High diversity
	Shannon, *H'*	3.322±0.000	High diversity
	Evenness, $e^{H/S}$	0.007±0.000	No evenness

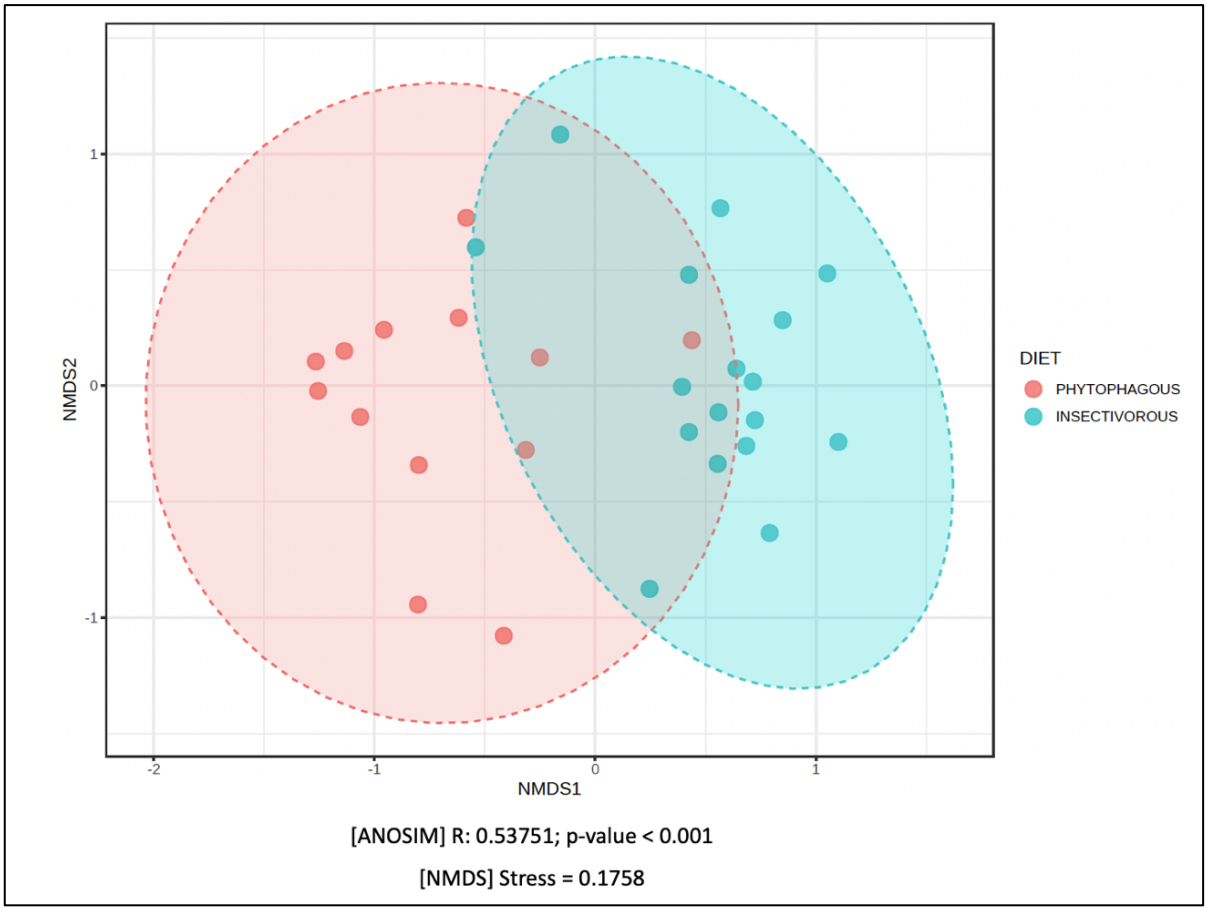


Figure 4.2: Non-metric multidimensional scaling (NMDS) analysis. Each point on the graph represents a single sample. The distance between two points indicates the degree of dissimilarity. The stress values less than 0.2 imply that the NMDS analysis is valid. The greater their similarity, the closer together the samples are in the graph.

Relative abundance of gut microbiome

A total of 27 bacteria phyla were identified from the sample set. To streamline the data presentation, top 10 phyla and the top five families, ranked by relative abundance, were highlighted in Figure 4.3. Three most common bacterial phyla for both bats diet were Firmicutes, Proteobacteria and Campylobacterota. Comparing the relative abundance of microbial taxa between phytophagous and insectivorous bats, several notable trends were observed, though none were statistically significant (Mann-Whiteney U test: $p > 0.05$), phytophagous bats host higher percentage of Firmicutes (72% vs 52%) and Campylobacterota (11% vs 1%) whereas insectivorous bats have a higher Proteobacteria percentage (45% vs 14%) (Figure 4.3A)

Analysing the family relative abundance, a large percentage of Streptococcaceae was detected in phytophagous (46% vs 21%) whereas in insectivorous bats, higher percentage of Enterobacteriaceae (42% vs 10%) and Clostridiaceae (12% vs 5%) were detected. Both types of diet were having a similar percentage of Lactobacillaceae (8% vs 7%). Notably, compared to insectivorous bats, the Heliobacteraceae family was prominently detected in phytophagous bats (11% vs <1%) (Figure 4.3B). A comparative analysis of gut bacteria functional groups identified eight major groups in both phytophagous and insectivorous bats. These groups reveal distinct microbial functional patterns associated with each dietary preference. Both bat types show high detection of functional group related to fermentation. A notable difference is seen in the detection of aerobic chemoheterotrophy where

phytophagous bats have 344 detections, while insectivorous bats have 991 (figure 4.3C, table 4.2).

Table 4.2: The functional groups detected from both dietary groups.

Functional Group	PB	IB	Family	Phylum
Fermentation	680	1068	Lactobacillaceae, Enterobacteriaceae	Bacillota, Pseudomonadota
Nitrate respiration	38	141	Enterobacteriaceae, Pseudomonadaceae	Pseudomonadota
Nitrate reduction	257	511	Enterobacteriaceae, Rhodobacteraceae	Proteobacteria, Pseudomonadota
Aerobic chemoheterotrophy	344	991	Bacillaceae, Enterococcaceae	Bacillota, Firmicutes
Nitrite respiration	20	55	Comamonadaceae, Enterobacteriaceae	Pseudomonadota
Sulfate respiration	3	77	Desulfovibrionaceae, Desulfobacteraceae	Proteobacteria, Firmicutes
Nitrogen fixation	14	76	Rhizobiaceae, Bradyrhizobiaceae	Proteobacteria
Chitinolysis	9	22	Bacillaceae, Enterobacteriaceae	Bacillota, Firmicutes

*PB=Phytophagous bats, IB=Insectivorous bats

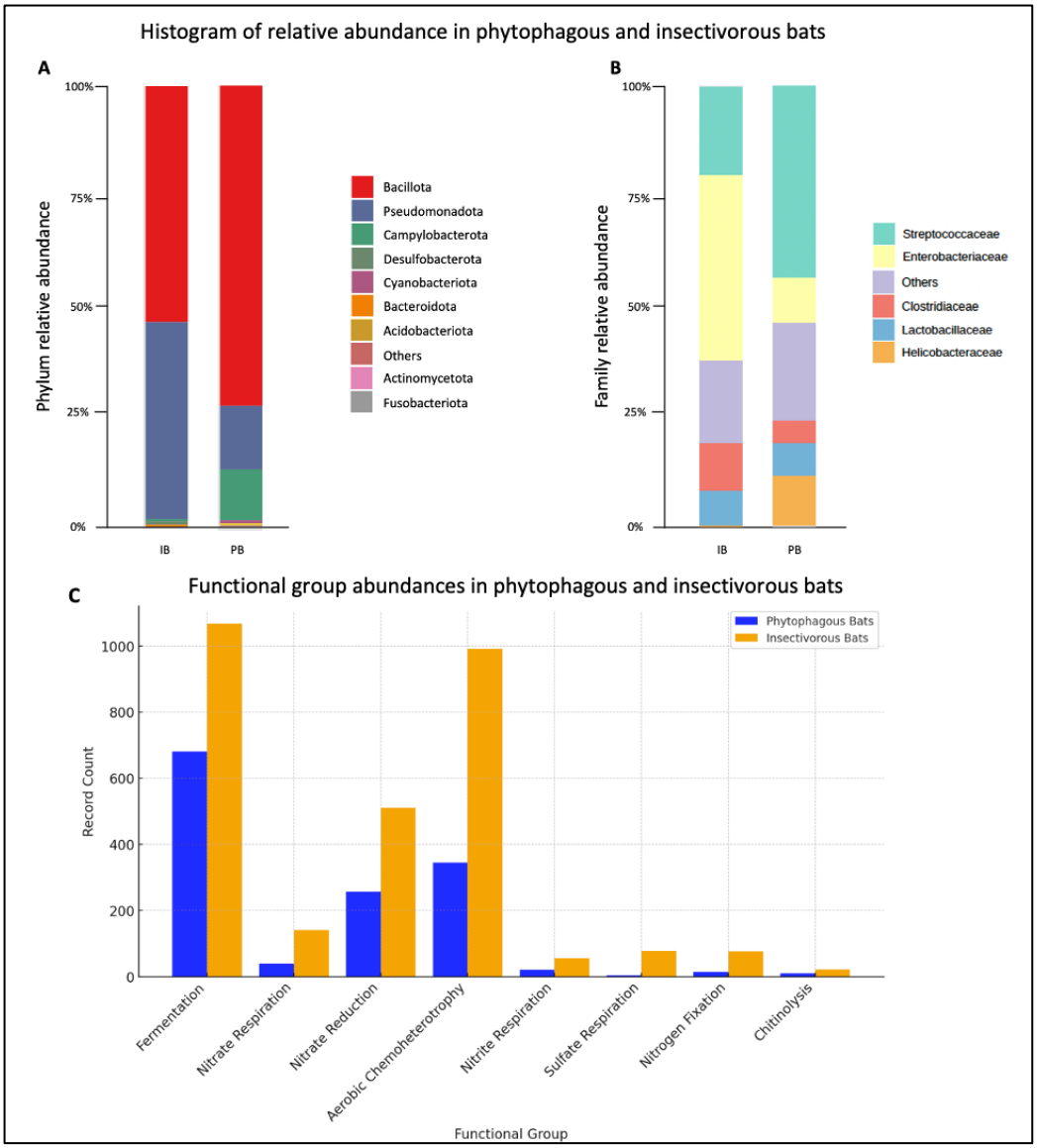


Figure 4.3: Histogram of relative and functional group abundance. (A) Relative abundance of the top 10 phylum. (B) Relative abundance of the top 5 families. Other phyla below top 10 and families below top 5 were grouped as “Others”. IB = Insectivorous bats, PB = Phytophagous bats. (C) Functional group abundance in phytophagous and insectivorous bats.

Bacterial correlation network

Analysis of bacterial correlation networks utilising SparCC correlation coefficients produced both positive and negative correlation network (Figure 4.4). This study had successfully identified a total of 117 bacterial genera nodes that showed microbial associations within the bat's microbiome community. The range of absolute correlation coefficient values were from -0.6594 to 0.8583. The nodes indicate different genus of bacteria, while the edges reflect the correlation coefficients between different genera. The nodes size represents the abundance and coloured according on their respective diet groups. Due to high number of correlations, only correlation networks of randomly selected *Lactococcus* and *Lactobacillus* were highlighted to show examples of positive and negative correlations. The full list of bacteria genus correlation table can be referred at Appendix 2.

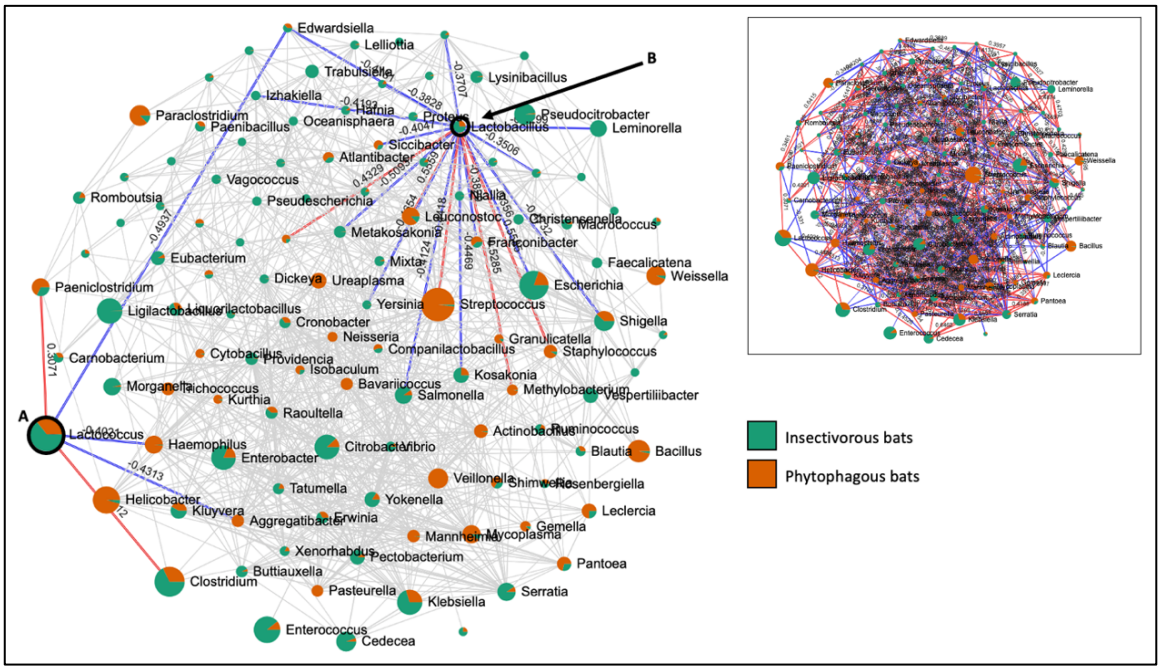


Figure 4.4: The SparCC correlation network. The image shows the correlation network of bacteria genera harboured by the bats. Node labelled A represent *Lactococcus* and node B represent *Lactobacillus*. The blue bar represents negative correlations, while red bar represents positive correlations. The digit on the bar showed the correlation value. The small inset figure displayed all correlations values for 117 nodes.

4.3 Discussion

The microbiota diversity between the two feeding guilds.

The results presented in this study were obtained from 17 insectivorous and 13 phytophagous bats. Although the number of phytophagous bat individuals studied here is fewer than those from the insectivorous group, a slightly more diverse microbiome was recovered from the phytophagous bats as compared to the insectivorous bats (table 4.1). Due

to the low number of samples, this data needed to be treated with caution, but nevertheless, it provides a baseline information on gut microbiome studies in Bornean bats. The plant-based diet contains complex plant materials such as hemicellulose, lignin derivatives, and insoluble starches. As a result, digestive systems will require enzymes from a wide range of microbe species, sustaining a rich biodiversity in the digestive system environment (Karasov et al., 2011).

The high microbiome diversity detected in insectivorous bats was also documented in previous bat-microbe studies (e.g., Carillo-Arujo et al., 2015; Li et al., 2018). The nutrient requirements for these bats to survive in the wild are enormous; thus, during foraging, each bat individual is estimated to consume 61–84% of their body mass, or at least 4.8 grams of arthropods per night (Bateman & Vaughan, 1974; Kalka & Kalko, 2006). This large amount of insect consumption resulted in a diet that is heavy in proteins, fats, and nutrients. This condition could foster and make it an ideal environment for the growth of bacteria, thus contributing to the high bacterial diversity observed in this study. Similar diversity was observed for both diet groups, showing a relatively balanced bacterial composition.

The relative and functional abundance of gut bacteria in bats

Fermentation was one of the most dominant functional groups in both phytophagous and insectivorous bats, with higher records in insectivorous bats (1068 vs. 680). This aligns with the presence of Bacillota in both groups, which are known for their role in carbohydrate

fermentation (Plaza-Díaz et al., 2002; Yang et al., 2024). Despite the higher prevalence of Bacillota in phytophagous bats (72% ± 5% vs. 52% ± 3%), insectivorous bats exhibited a higher overall fermentation function, likely due to the substantial presence of Enterobacteriaceae (42% ± 1% vs. 10% ± 1%), a family that contributes to sugar metabolism (Leonhartsberger et al., 2011; Le Bouguénec & Schouler, 2011). This indicates that functional dominance is influenced not just by phylum-level abundance but also by specific bacterial families and their metabolic activity.

Insectivorous bats exhibited significantly higher nitrate respiration (141 vs. 38) and nitrate reduction (511 vs. 257) compared to phytophagous bats. This corresponds with their higher relative abundance of Pseudomonadota (45% ± 2% vs. 14% ± 1%) and Enterobacteriaceae, both of which contain taxa involved in nitrogen cycling (Behar et al., 2005; Khomutovska et al., 2024). The high nitrate-processing capability in insectivorous bats suggests an adaptation to their nitrogen-rich diet, derived from protein-heavy insect consumption (Roswag et al., 2014; Campbell et al., 2017). Conversely, the lower levels of nitrate respiration and reduction in phytophagous bats may reflect their carbohydrate-dominant diet, which produces less nitrogenous waste (Larson & Chaikoff, 1937; Long et al., 1977; Bisschop et al., 2003).

Aerobic chemoheterotrophy was substantially higher in insectivorous bats (991 vs. 344), indicating a greater metabolic flexibility in utilizing organic compounds. The functional potential for this process is associated with Bacillaceae, a family within Bacillota

(Mandic-Mulec et al., 2016; Shen et al., 2022; Chen et al., 2024). While phytophagous bats had a greater overall Bacillota representation, insectivorous bats exhibited higher functional activity, likely due to the greater need for diverse metabolic pathways to break down insect-derived macromolecules.

Nitrite and sulfate respiration were also higher in insectivorous bats (55 vs. 20 and 77 vs. 3, respectively). The families Comamonadaceae and Enterobacteriaceae (Pseudomonadota) contributed to nitrite respiration (Stewart, 1988; Stewart, 1994; Ethebehere et al., 2001; Khan et al., 2002; Willems, 2014), while Desulfovibrionaceae and Desulfobacteraceae (Proteobacteria, Bacillota) were responsible for sulfate respiration (Matias et al., 2005; Keller & Wall, 2011). The greater sulfate-reducing capacity in insectivorous bats aligns with their higher intake of protein, which contains sulfur-rich amino acids (Brosnan & Brosnan, 2006; Nimni & Cordoba, 2007; Courtney-Martin & Pencharz, 2016). In contrast, phytophagous bats, consuming plant-based diets with lower sulfur content, demonstrated minimal sulfate respiration activity (Ingenbleek, 2006; Kahleova et al., 2018; Dostal et al., 2019).

Chitinolysis was recorded at a higher rate in insectivorous bats (22 vs. 9), reflecting their consumption of insect exoskeletons composed of chitin (Phillips et al., 2012). This function is primarily associated with Bacillaceae and Enterobacteriaceae (Bacillota) Chernin et al., 1997; Phillips et al., 2012; Zhang et al., 2014; Mallakuntla et al., 2017; Sivaramakrishna et al., 2020). The relatively low chitinolytic activity in phytophagous bats

further reinforces the link between diet and microbiome functional roles, as plant-based diets do not necessitate chitin degradation, but rather more on degradation of plant polysaccharides (Ley et al., 2008)

Overall, these findings highlight that while bacterial phylum- and family-level abundances provide an overview of microbial composition, they do not always predict functional activity. The functional adaptations observed in insectivorous and phytophagous bats reflect their dietary specializations, with insectivorous bats demonstrating greater metabolic flexibility in nitrogen cycling, sulfate respiration, and chitinolysis, while phytophagous bats exhibit a microbiome more specialized in carbohydrate fermentation. These results emphasize the importance of integrating taxonomic and functional analyses for a comprehensive understanding of gut microbiome ecology in bats.

Bacterial correlation network analysis

The correlation network analysis was used and managed to interpret the complex microbial interaction within two different bat diet preferences (figure 4.4). For example, the genus *Lactococcus* is positively related to *Clostridium, Helicobacter,* and *Paeniclostridium.* Suggesting that they are somehow aiding each other's growth and/or survival in the bat gut. Previous research suggests that metabolic cross-feeding and co-survival in the environment may be the key elements generating the favourable correlations observed between microbiomes (Raes & Bork, 2008; Banskar et al., 2016).

The majority of members within the genus *Lactobacillus* are probiotic bacteria, which is a good bacterium (Reid & Burton, 2002; Arshad et al., 2018; Mazkour et al., 2019; Cao et al., 2020; Afrin et al., 2021). The correlation network analysis revealed a negative relationship with 13 other bacterial genera. Some notable negative correlations are with the known pathogenic *Brenneria*, *Edwardsiella*, *Escherichia*, *Kosakonia*, *Leminorella*, *Metakosakonia*, *Pluralibacter*, *Salmonella*, *Shigella,* and *Yersinia*. The negative association suggests the presence of competition for the available resources, which signals its efforts to displace the surrounding bacteria (Faust et al., 2012; Banskar et al., 2016). The significance of both good and bad bacteria in the gut microbiome is pivotal for various physiological functions involving an enormous community of microbiomes.

4.4 Conclusions

This study successfully determined the gut microbiome community profiles of insectivorous and phytophagous bats in Borneo. The bacterial composition naturally correlates to the dietary preferences of bats. These data indicate that though bacterial phylum- and family-level abundances offer a general understanding of microbial composition, they do not dependably indicate the functional activity. Through correlation network analysis, it has been established that probiotic bacteria such as *Lactobacillus* play a crucial function in bats. They are negatively correlated with several well-known bacterial pathogens, such as *Salmonella* and *Yersinia*, indicating that they compete with these

pathogens for resources. While the sample size is small, this study provides valuable insights into the functional diversity of gut microbiomes in insectivorous and phytophagous bats in Borneo, a region where such data is particularly scarce. The findings highlight how dietary preferences are linked to distinct functional groups of bacterial communities, contributing to the understanding of microbial ecology in these bat species. This research fills a significant data gap in Borneo, offering a foundational basis for future studies to explore the ecological and ecosystem roles of gut microbiomes in bats. Future research should focus on expanding sample sizes for more robust conclusions as well as investigating the potential implications of gut microbiomes in areas such as zoonotic disease transmission, biodiversity conservation, and their role in ecosystem health. This provides pathways for future research that will elucidate the nature of the symbiotic relationship between microflora communities and hosts.

CHAPTER 5

THE ROLE OF BORNEAN BATS IN BACTERIAL PATHOGEN SPREAD, RESEVOIRS AND ANTIMICROBIAL RESISTANCE

5.1 Introduction

Malaysian Borneo has remarkable biodiversity that includes a diverse range of animal species, including bats. Bats play a crucial role in maintaining ecological equilibrium through their role in several events, including seed distribution, promoting the growth of plants, and managing insect populations (Jones et al., 2009; Ramírez-Fráncel et al., 2022; Beilker & O'Keefe, 2023; Tuneu-Corral et al., 2023). The presence of distinctive environments specifically forest types in Malaysian Borneo has led to the identification and studies of a wide range of bat species, each of which plays specific ecological functions within the ecosystem (Morni et al., 2018; Rosli et al., 2018; Khan et al., 2019; Jinggong & Khan, 2022; Habeebur-Rahman et al., 2023).

Their extended lifespan, the ability for flight, and adaptability to diverse ecological niches contribute to bats' high survivorship allowed for the co-existence of multiple bat species (Munshi-South & Wilkinson, 2010; Wilkinson & Adams, 2019). However, these traits have also led to global concern regarding bats as potential reservoirs of zoonotic pathogens and vectors, given their exposure to a wide array of microorganisms (Calisher et al., 2006; Wong et al., 2007; Whitaker et al., 2009; Wibbelt et al., 2009; Kuzmin et al., 2011; Wang et al., 2011; Letko et al., 2020; Hoyt et al., 2021; Szentivanyi et al., 2023).

Some species of bats occupy areas near human settlements and often involuntary became the intermediate hosts for pathogens then spread them to human, domestic animals and crops (Dutheil et al., 2021; Ramanantsalama et al., 2022; Schloesing et al., 2023). Besides, bats have the potential to transmit infections to people via the consumption of contaminated bat flesh, given that bats are used as a food source in some regions. This may deliberately facilitate the transmission of pathogenic bacteria to humans (Wood et al., 2012; Veikkolainen et al., 2014).

The study of antibiotic resistance in pathogenic and opportunistic bacteria has received rising interest in the fields of human and veterinary medicine (Ramey & Ahlstrom, 2020; Torres et al., 2020; Laborda et al., 2022; Smoglica et al., 2023). In spite the absence of antibiotic prescription drugs in wild, the presence of antimicrobial-resistant organisms has been detected in wildlife (Rahuma et al., 2005; Costa et al., 2008; Molina-Lopez et al., 2011; Wyrsch et al., 2022). Despite of the considerable high attention given to investige the occurrence of antimicrobial resistance in wild animals, there is a lack of readily accessible data specifically concerning bats. This is especially critical in area with high diversity and endemicity such as Borneo.

The study of pathogenic and antibiotic resistance in bats is in accordance with the One Health framework, which acknowledges the interdependence of human, animal, and environmental well-being (Devnath et al., 2022; Li et al., 2022; Gunasekara et al., 2023). This kind of study will enhance an in-depth understanding of the many elements that influence the rise and transmission of antibiotic resistance bacteria. Consequently, it will enable a collaborative and inclusive approach to health management. This research provides a thorough investigation and discussion of the pathogenic bacteria present in Borneo's bats, along with their related antibiotic resistance characteristics.

5.2 Results

Detection of bats bacterial pathogens

Thirty individuals of bats were tested for pathogenic detection and all were positive for one or more bacterial pathogens (Table 5.1). These individuals harbor a total of 644 pathogenic species with 2,985,660 sequences detection. The bacterium was later grouped at the genus level and ranked based on the sequence abundance. The top five genera in the sample set that are more than 6% of the total bacteria relative abundance were further studied and discussed in detail. These five dominant genera were *Escherichia* spp. (27%), *Lactococcus* spp. (25%), *Enterococcus* spp. (12%), *Citrobacter* spp. (7%), *Shigella* spp. (6%) and the remaining genera grouped as others (23%) (Figure 5.1). Other significant pathogenic bacteria species that been reported in previous bats study such as *Campylobacter* spp., *Salmonella* spp., and *Bartonella* spp. were also detected but in a small occurrence (<1%).

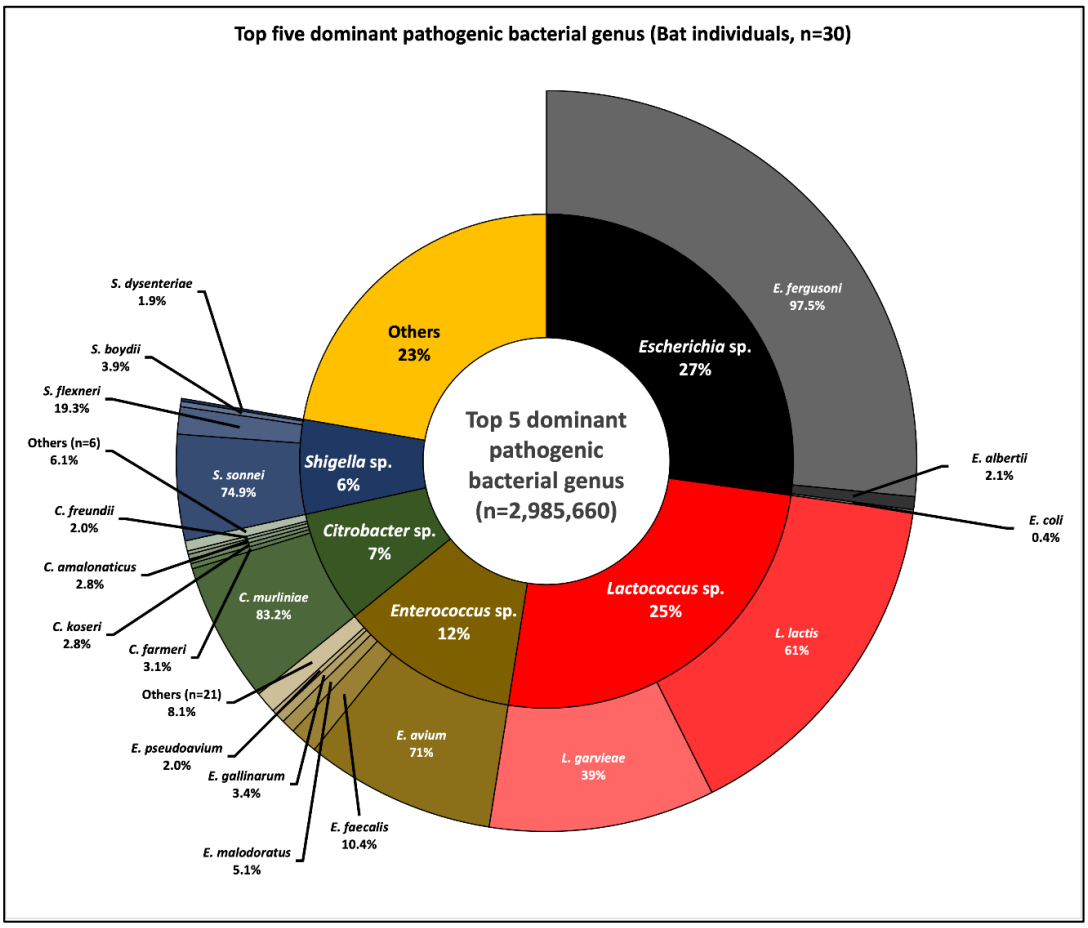


Figure 5.1: Donut graph showing the top five dominant pathogenic bacterial genera detected in this study. n = sequence detections (>6% of total bacteria relative abundance).

Table 5.1: List of bacteria species, abbreviation and organism category in association with its host bats species.

Bacteria species	Abbv.	n[a]	Host species	NHSN Organism Category
***Citrobacter* spp.**				
C. amalonaticus	Cam	16/30	Cbrac, Dspad, Gtylo, Kminu, Racum, Raffi, Rphil, Rsedu, Rtrif, Tpach	MBI/UTI

C. braakii	Cbr	14/30	Cbrac, Dspad, Gtylo, Kminu, Mmini, Racum, Raffi, Rphil, Rsedu, Rtrif, Tpach, Trobu	MBI/UTI
C. farmer	Cfa	13/30	Dspad, Gtylo, Hdiad, Kminu, Mmini, Mrid, Racum, Rphil, Rsedu, Rtrif, Tpach	MBI/UTI
C. freundii	Cfr	16/30	Bmacu, Dspad, Gtylo, Kminu, Mmini, Mridl, Racum, Raffi, Rphil, Rsedu, Rtrif, Tpach, Trobu	MBI/UTI
C. gillenii	Cgi	15/30	Cbrac, Dspad, Gtylo, Kminu, Mmini, Mmuri, Racum, Raffi, Rphil, Rsedu, Rtrif, Tpach, Trobu	MBI/UTI
C. koseri	Cko	19/30	Cbrac, Dspad, Gtylo, Khard, Kminu, Mmini, Mridl, Racum, Raffi, Rphil, Rsedu, Rtrif, Tpach, Trobu	MBI/UTI
C. murliniae	Cmu	19/30	Cbrac, Dspad, Gtylo, Khard, Kminu, Mmini, Mmuri, Racum, Raffi, Rphil, Rsedu, Rtrif, Tpach, Trobu	MBI/UTI
C. rodentium	Cro	11/30	Dspad, Gtylo, Kminu, Mridl, Raffi, Rphil, Rsedu, Rtrif, Tpach	MBI/UTI
C. sedlakii	Cse	12/30	Dspad, Gtylo, Kminu, Mridl, Racum, Raffi, Rphil, Rsedu, Rtrif, Tpach	MBI/UTI
C. werkmanii	Cwe	14/30	Cbrac, Dspad, Gtylo, Khard, Kminu, Mmini, Racum, Raffi, Rphil, Rsedu, Rtrif, Tpach, Trobu	MBI/UTI
C. youngae	Cyo	13/30	Dspad, Gtylo, Kminu, Mmini, Mridl, Racum, Raffi, Rphil, Rsedu, Rtrif, Tpach	MBI/UTI

***Enterococcus* spp.**				
E. asini	Eas	16/30	Cbrac, Dspad, Gtylo, Khard, Kminu, Mmini, Mmuri, Racum, Raffi, Rphil, Rsedu, Rtrif, Trobu, Tpach, Trobu	MBI/UTI
E. avium	Eav	23/30	Bmacu, Cbrac, Dspad, Gtylo, Hdiad, Khard, Kminu, Mmini, Mmuri, Mridl, Racum, Raffi, Rphil, Rsedu, Rtrif, Tpach, Trobu	MBI/UTI
E. canis	Ecan	19/30	Bmacu, Cbrac, Dspad, Gtylo, Hdiad, Khard, Kminu, Mmini, Mmuri, Mridl, Racum, Raffi, Rphil, Rsedu, Rtrif, Tpach, Trobu	MBI/UTI
E. casseliflavus	Ecas	12/30	Cbrac, Dspad, Gtylo, Khard, Mmini, Racum, Rphil, Rsedu, Rtrif, Tpach, Trobu	MBI/UTI
E. cecorum	Ece	12/30	Bmacu, Gtylo, Hdiad, Kminu, Mmini, Mmuri, Mridl, Racum, Rsedu	MBI/UTI
E. dispar	Edi	12/30	Bmacu, Cbrac, Dspad, Gtylo, Mmini, Racum, Raffi, Rphil, Rsedu, Tpach, Trobu	MBI/UTI
E. durans	Edu	11/30	Cbrac, Dspad, Gtylo, Mmini, Racum, Rphil, Rsedu, Rtrif, Tpach, Trobu	MBI/UTI
E. faecalis	Efa	21/30	Cbrac, Dspad, Gtylo, Hdiad, Khard, Kminu, Mmini, Mmuri, Mridl, Racum, Raffi, Rphil, Rsedu, Rtrif, Tpach, Trobu	MBI/UTI

E. gallinarum	Ega	16/30	Cbrac, Dspad, Gtylo, Hdiad, Kminu, Mmini, Racum, Raffi, Rphil, Rsedu, Rtrif, Tpach	MBI/UTI
E. gilvus	Egi	12/30	Gtylo, Mmini, Mmuri, Racum, Raffi, Rphil, Rsedu, Rtrif, Tpach, Trobu	MBI/UTI
E. malodoratus	Ema	17/30	Bmacu, Cbrac, Gtylo, Hdiad, Khard, Kminu, Mmini, Mmuri, Mridl, Racum, Raffi, Trobu	MBI/UTI
E. mundtii	Emu	8/30	Gtylo, Hdiad, Kminu, Mmini, Mmuri, Rsedu, Rtrif	MBI/UTI
E. pallens	Epa	10/30	Bmacu, Gtylo, Hdiad, Kminu, Mmini, Mmuri, Mridl, Rtrif	MBI/UTI
E. pseudoavium	Eps	18/30	Bmacu, Cbrac, Gtylo, Hdiad, Kminu, Mmini, Mmuri, Mridl, Racum, Raffi, Rsedu, Rtrif	MBI/UTI
E. sulfureus	Esu	13/30	Bmacu, Gtylo, Hdiad, Kminu, Mmini, Mmuri, Mridl, Racum, Rphil, Rsedu, Rtrif	MBI/UTI
***Escherichia* spp.**				
E. alberti	Eal	11/30	Dspad, Gtylo, Kminu, Mridl, Raffi, Rphil, Rsedu, Rtrif, Tpach	MBI/UTI
E. coli	Eco	14/30	Dspad, Gtylo, Kminu, Mmini, Mridl, Raffi, Rphil, Rsedu, Rtrif, Tpach, Trobu	MBI/UTI
E. fergusonii	Efe	18/30	Cbrac, Dspad, Gtylo, Kminu, Mmini, Mmuri, Mridl, Raffi, Rphil, Rsedu, Rtrif, Tpach, Trobu	MBI/UTI
***Lactococcus* spp.**				
L. garvieae	Lga	20/30	Bmacu, Cbrac, Gtylo, Hdiad, Khard, Kminu, Mmini, Mmuri,	UTI

			Racum, Raffi, Rphil, Rsedu, Rtrif, Tpach, Trobu	
L. lactis	Lla	27/30	Bmacu, Cbrac, Dspad, Gtylo, Hdiad, Khard, Kminu, Mmini, Mmuri, Mridl, Racum, Raffi, Rphil, Rsedu, Rtrif, Tpach, Trobu	UTI
***Shigella* spp.**				
S. boydii	Sbo	11/30	Dspad, Gtylo, Kminu, Mmini, Raffi, Rsedu, Rtrif, Tpach, Trobu	UTI
S. dysenteriae	Sdy	11/30	Dspad, Gtylo, Kminu, Mmini, Mridl, Rphil, Rsedu, Rtrif, Tpach	UTI
S. flexneri	Sfl	15/30	Cbrac, Dspad, Gtylo, Kminu, Mmini, Mmuri, Raffi, Rphil, Rsedu, Rtrif, Tpach, Trobu	UTI
S. sonnei	Sso	15/30	Cbrac, Dspad, Gtylo, Kminu, Mmini, Mmuri, Raffi, Rphil, Rsedu, Rtrif, Tpach	UTI

Abbv.: Abbreviation; n^a: number of bat individual that carry specific bacteria; NHSN: National Healthcare Safety Network; MBI: mucosal barrier injury; UTI: urinary tract infection. Abbreviation for host species follows Table 3.1.

Pathogenic bacteria inter-species coinfection

The bacteria interactions are very complex and evidently coexist within a single host species. The inter-species coinfection was investigated and visualised through Figure 5.2. A connection (string) is drawn between a bacterial taxon and a host species if the bacterium is detected in that species. The parameter used to establish these interactions is the presence or absence of bacterial taxa in a species, which a connection is made when a bacterium is

detected, and no connection is made when it is absent. *Rhinolophus sedulus* and *T. pachypus* recorded the highest inter-species coinfection with 35 pathogenic bacteria species. This followed by *R. philippinensis*, *R.trifoliatus* and *G. tylophus* with 34 species. The least bacteria inter-species coinfection is nine species, detected in *H. diadema* and *B. maculata*. The most common pathogenic bacteria species found in the bats are *E. avium*, *E. canis* and *L. lactis* that harboured by 17 bats species. The least common is *E. mundtii* that detected in eight bat species.

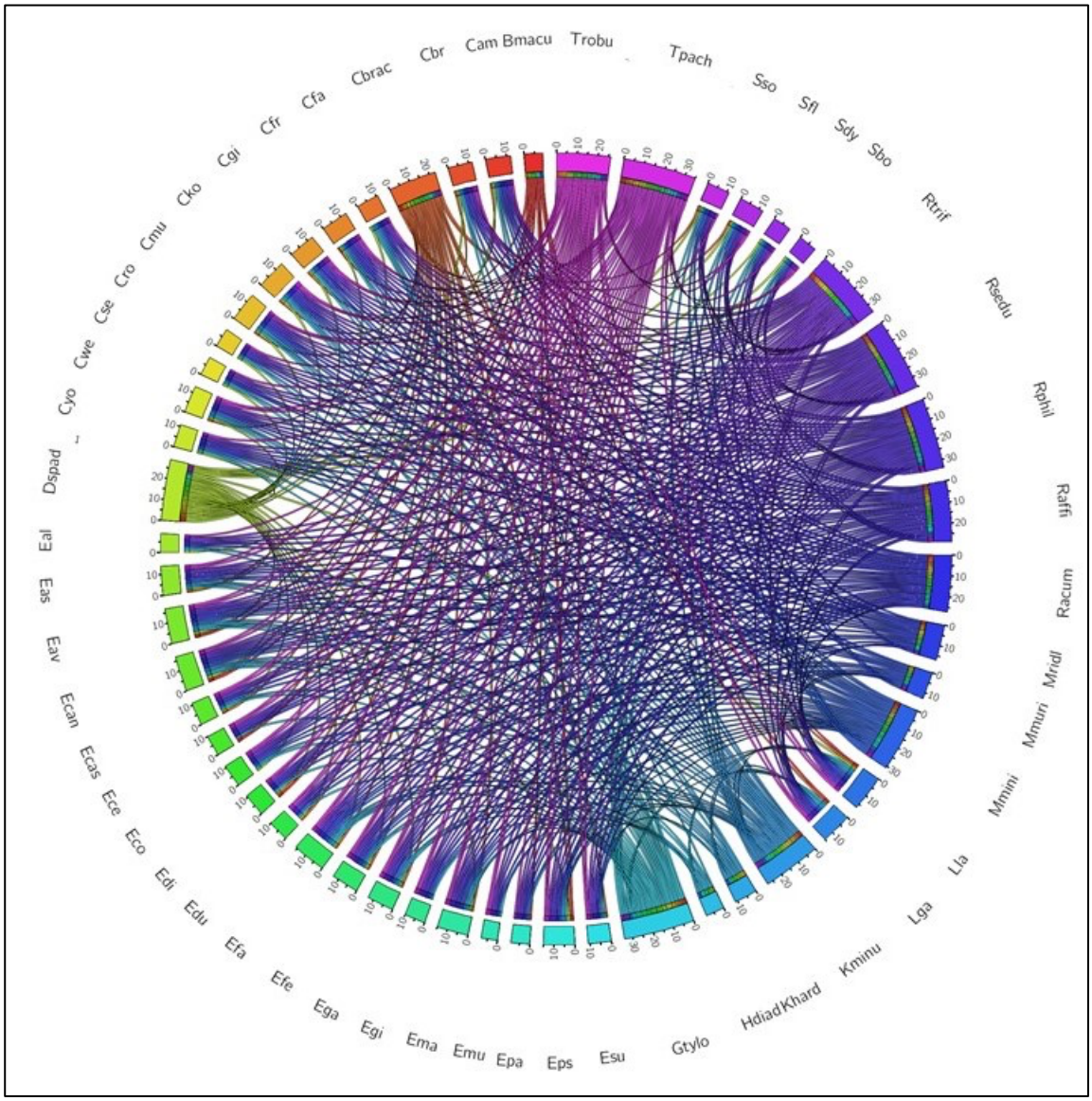


Figure 5.2: Circos map showing the bacteria species coinfection in relative to each bat's species. Bat individuals' abbreviation follows Table 3.1, whereas bacteria species abbreviation follows Table 5.1. The number on the outer circle shows the number of interactions for each node.

Pathogenic bacteria – Bat's physiology and ecology

The physiological and ecological factors related to bats could possibly influence the chances of the pathogenic bacterial infection. Hence several parameters such as bat's diet, systematics, gender, and habitat range were further investigated. The diet and systematics of the bats does influence the composition of the pathogenic bacteria, while no significant difference was detected in habitat types and gender (Figure 5.3).

The insectivorous bats have a significant difference when compared to both frugivorous and nectarivorous bats ($P<0.05$), whereas between the bats that opted for plant-based diet, no significant difference is detected. The bats were also grouped into their respective family, calculated, and showed three interactions with significant difference. The bacteria composition harbored by bats from family Hipposideridae is significantly different compared to Pteropodidae and Vespertilionidae, as well as for Vespertilionidae with Rhinolophidae. There are no significant differences for the habitat and gender factor. The presence of *Lactococcus* spp. is consistently detected with high prevalence throughout the sample set. As opposed to the bacteria's genus trend discovered in this study, *Escherichia* spp. and *Shigella* spp. are not detected in bat's family Hipposideridae, suspected due to low number of individuals from this family.

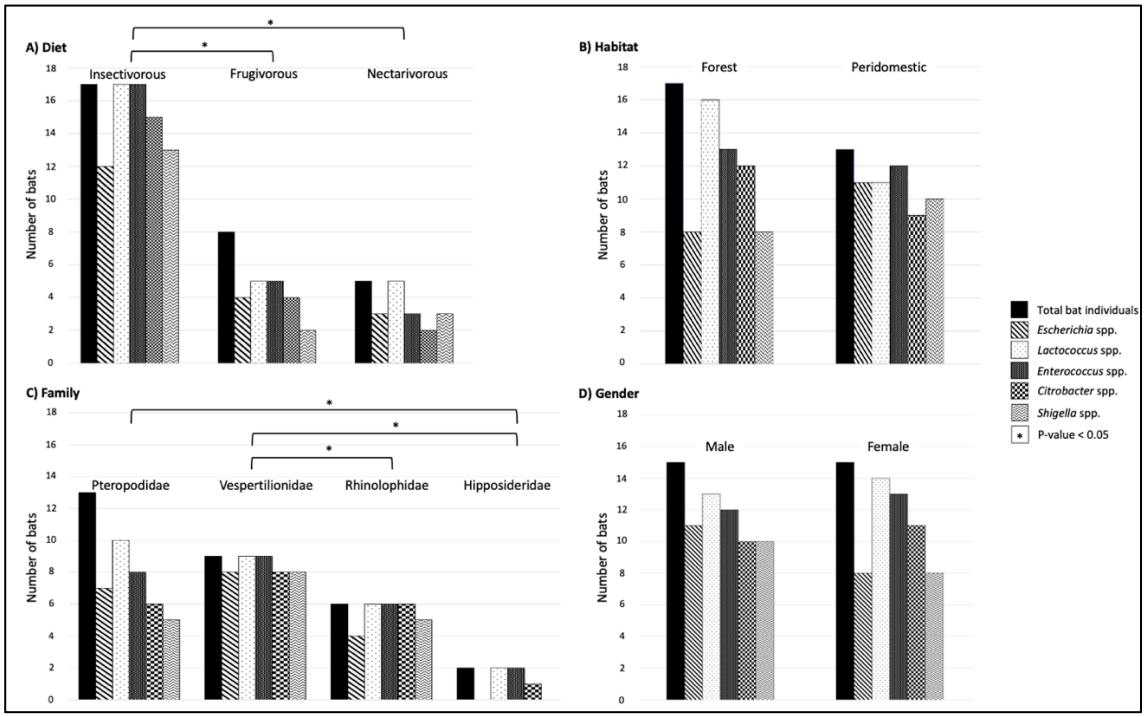


Figure 5.3: Number of bats infected with *Escherichia* spp., *Lactococcus* spp., *Enterococcus* spp., *Citrobacter* spp. and *Shigella* spp. tested on four different factors. (A) Diet, (B) Habitat, (C) Family, (D) Gender.

The annotated checklist of medically important pathogenic bacteria reported in bats

The bat's pathogenic bacteria profiling has been reported by many previous studies. The updated checklist reported herein is consisting of compiled data from previously published studies and this study (Table 5.2).

Table 5.2: Common medically important pathogenic bacteria genera associated with bats reservoirs.

Bacteria pathogens	Known bats reservoirs	Bat reservoirs detected from this study	Reference(s)
Anaplasma spp.	*Rhinolophus creagi, R. sedulus, R. borneensis*	None detected	Mahyudin et al., 2022
Bartonella spp.	*Artibeus toltecus, Carollia perspicillata, Coleura afra, Cynopterus brachyotis, Desmodus rotundus, Eidon helvum, Eptesicus nilssonii, Glossophaga soricina, Hipposideros armiger, H. commersoni, H. larvatus, Megaderma lyra, M. spasma, Micronycteris microtis, Miniopterus schreibersii, Miniopterus spp., Myotis adversus, M. davidii, M. mystacinus, Phyllostomus discolor, Pteronotus davyi, P. parnellii, Rhinolophus acuminatus, R. chaseli, R. pusillus, R. sinicus, Rousettus aegyptiacus, Sturnira lilium, Triaenops persicus*	*Glischropus tylophus, Macroglossus minimus, Rhinolophus acuminatus, R. philippinensis*	Kosoy et al., 2010; Bai et al., 2011; Lin et al., 2012; Veikkolainen et al., 2014; Han et al., 2022; Low et al., 2022; Gonçalves-Oliveira et al., 2023; Nabeshima et al., 2023
Borellia spp.	*Artibeus lituratus, Carollia perspicillata, Desmodus rotundus, Eptesicus fuscus, Glossophaga soricina, Miniopterus schreibersii, Mormoops megalophylla, M. bechsteinii, M. blythii, M. brandtii, M. daubentoniid, M. daubentoniid, M. davidii, M. emarginatus, M. myotis, M. mystacinus, M. nattereri, M. ricketti, Natalus tumidirostris, Phyllostomus discolor, Pipistrellus kuhlii, P. pipistrellus, Pipistrellus sp., Rhinolophus hipposideros, R. pusillus, Uroderma* sp.	None detected	Marinkelle & Grose, 1968; Hubbard et al., 1998; Loftis et al., 2005; Reeves et al., 2006; Evans et al., 2009; Schwan et al., 2009; Piksa et al., 2016; Han et al., 2020; Michalik et al., 2020; Li et al., 2021; Muñoz-Leal et al., 2021; Jorge et al., 2023; López et al., 2023

Campylobacter spp.	*Myotis bechsteinii, M. dasycneme, M.daubentoniid, M. emarginatus, Nyctalus noctule, Pipistrellus pipistrellus, Rousettus amplexicaudatus*	*Glischropus tylophus, Kerivoula minuta*	Hatta et al., 2016; Hazeleger et al., 2018
Citrobacter spp.	*Cynopterus sphinx, C. titthaecheilus, Eonycteris spelaea, Eptesicus serotinus, Megaderma lyra, Myotis scotti, Pteropus giganteus, Rhinolophus macrotis, R. simplex, Rousettus leschenaultii, Tophozous perforates*	*Balionycteris maculata, Cynopterus brachyotis*, Dyacopterus spadiceus, Glischropus tylophus, Hipposideros diadema, Kerivoula hardwickii, K. minuta, Macroglossus minimus, Myotis muricola*, M. ridleyi, Rhinolophus acuminatus, R. affinis, R. borneensis, R. philippinensis, R. sedulus, R. trifoliatus, Saccolaimus saccolaimus, Tylonycteris pachypus, T. robustula*	Graves et al., 1988; Anand & Sripathi, 2004; Fajri et al., 2018; Wolkers-Rooijackers et al., 2018
Coiella burnetti	*Rhinolophus borneensis, R. creagi, Hippsideros cervinus*	None detected	Mahyudin et al., 2022

Enterococcus spp.	*Megaderma lyra, Myotis daubentonii, M. daubentonii, M. myotis, M. mystacinus, M. nattereri, Pipistrellus pipistrellus, Plecotus auratus, Tadarida brasiliensis*	*Balionycteris maculata, Cynopterus brachyotis, Dyacopterus spadiceus, Glischropus tylophus, Hipposideros diadema, Kerivoula hardwickii, K. minuta,* *Macroglossus minimus, Myotis ridleyi, M.muricola, Pipistrellus stenopterus, Rhinolophus acuminatus, R. affinis, R. borneensis, R. philippinensis, R.sedulus, R. trifoliatus, Saccolaimus saccolaimus, Tylonycteris pachypus, T. robustula*	Wolkers-Rooijackers et al., 2018; Costa et al., 2019; Gerbáčová et al., 2020; Nowakiewicz et al., 2021

Escherichia spp.	*Cynopterus sphinx, C. titthaecheilus, Desmodus rotundus, Eidolon helvum, Eonycteris spelaea, Epomops franqueti, Hipposideros diadema, Hypsignathus monstrosus, Megaderma lyra, Myonycteris torquate, Nycteris hispida, Ptenochirus jagori, Pteropus poliocephalus, Rosettus aegyptiacus, R. amplexicaudatus, Scotophillus kuhlii, Tadarida teniotis*	*Cynopterus brachyotis*, Dyacopterus spadiceous, Glischropus tylophus, Hipposideros dyacorum, Kerivoula minuta, Macroglossus minimus, Myotis muricola*, M. ridleyi, Rhinolophus affinis, R. borneensis, R. philippinensis, R. sedulus, R. trifoliatus, Saccolaimus saccolaimus, Tylonycteris pachypus, T. robustula*	Graves et al., 1988; Italia et al., 2012; Nowak et al., 2017; Fajri et al., 2018; Garcês et al., 2019; McDougall et al., 2021; Obodoechi et al., 2021; Oladiran et al., 2022
Lactococcus spp.	*Hipposideros armiger, H. cervinus, Myotis myotis, M. scotti, Rhinolopus macrotis, Rousettus leschenaultia, Tadarida brasiliensis, Taphozous perforates*	*Balionycteris maculata, Cynopterus brachyotis, Dyacopterus spadiceus, Glischropus tylophus,*	Newman et al., 2018; Gerbáčová et al., 2020; Liu et al., 2022

Lactococcus spp. (Cont.)		*Hipposideros diadema, H. dyacorum, Kerivoula hardwickii, K. minuta, Macroglossus minimus, Myotis muricola, M. ridleyi, Pipistrellus stenopterus, Rhinolophus acuminatus, R. affinis, R. borneensis, R. philippinensis, R. sedulus, R. trifoliatus, Saccolaimus saccolaimus, Tylonycteris pachypus, T. robustula*	
Leptospira spp.	*Balionycteris maculata, Carollia perspicillata, Chaerephon pusillus, Cynopterus brachyotis, Eonycteris spelaea, Eptesicus serotinus, Hipposideros cervinus, Hypsugo anchietae, Miniopterus gleni, M. griffithsi, M. griveaudi, M. mahafaliensis, Mormoops megalophylla, Mormopterus jugularis, Myotis fimbriatus, M. goudoti, M. pequinius, M. ricketti, Myotis spp., Natalus tumidirostris, Otomops madagascariensis,*	None detected	Smith et al., 1961; Lagadec et al., 2012; Thayaparan et al., 2015; Han et al., 2018; Silva-Ramos et al., 2022

Salmonella spp.	*Lasiurus blossevilli, Megaderma lyra, Miniopterus australis, M. schreibersi, Molossus ater, M. major, Pteropus giganteus*	*Balionycteris maculata, Cynopterus brachyotis, Dyacopterus spadiceus, Glischropus tylophus, Kerivoula hardwickii, K. minuta, Macroglossus minimus, Myotis ridleyi, Rhinolophus acuminatus, R. affinis, R. philippinensis, R. sedulus, R. trifoliatus, Tylonycteris pachypus, T. robustula*	Adesiyun et al., 2009; Reyes et al., 2011; Islam et al., 2013; Ferreira et al., 2021
Shigella spp.	*Eonycteris spelaea, Hipposideros armiger, Molossus bondae*	*Cynopterus brachyotis, Dyacopterus spadiceus, Glischropus tylophus, Kerivoula minuta, Macroglossus minimus, Myotis muricola, M. ridleyi, Rhinolophus affinis, R. philippinensis, R. sedulus, R. trifoliatus, Tylonycteris pachypus, T. robustula*	Buckles, 2015; Sun et al., 2020

Staphylococcus spp.	*Artibeus fimbriatus, A. lituratus, Asellia tridens,Carollia perspicillata, Desmodus rotundus, Eidolon helvum, Eptesicus brasiliensis, Glassophaga soricine, Histiotus velatus, Micropteropus pusillus, Molossus molossus,*	*Balionycteris maculata, Cynopterus brachyotis, Dyacopterus spadiceus, Glischropus tylophus, Kerivoula minuta, Macroglossus minimus,*	Arata et al., 1968; Akobi et al., 2012; Vandžurová et al., 2013; Held et al., 2017; Olatimehin et al., 2018; Fountain et al., 2019;
	Myotis blythii, M. myotis, Myotis sp.*, Platyrrhinus lineatus, P. recifinus, Pteropus livingstonii, Pygoderma bilabiatum, Rhinolophus blasii, R. clivosus, R. euryale, Rousettus aegyptiacus, Sturnira lilium, Tadarida brasiliensis*	*Myotis muricola, Rhinolophus acuminatus, R. philippinensis, R. sedulus, R. trifoliatus, Tylonycteris pachypus, T. robustula*	Fountain et al., 2021; Mairi et al., 2021; Fountain et al., 2022; Garcês, 2022; Carillo Gaeta et al., 2023; Razik et al., 2023
Streptococcus spp.	*Desmodus rotundus, Rousettus* sp.	*Balionycteris maculata, Cynopterus brachyotis, Dyacopterus spadiceus, Glischropus tylophus, Hipposideros diadema, Kerivoula hardwickii, Macroglossus minimus, Myotis ridleyi, Rhinolophus acuminatus, R. philippinensis, R. sedulus, R. trifoliatus,*	Takada & Hirasawa, 2008; Mioni et al., 2018

*: Reported in both previous study and this study; Ref.:References; Cont.: Continue from previous page

Antibiotic Resistance in Wild Sarawak Bats

This study worked on 30 bats individuals comprising 17 species from four families. Of these, five individuals were detected to not having any bacteria with antibiotic resistance (AMR) properties. No AMR bacteria were harbored by member of Hipposideridae. The relationship between the bats species with AMR bacteria harbored are complex, as the AMR bacteria species were detected from multiple bat individuals, across different species. *Escherichia coli* was detected from 18 individuals of bat, showing resistance towards 12 antibiotic treatments. In total, the antibiotic resistance test on wild population of bats in Malaysian Borneo detected eight AMR bacteria species that exhibits resistance towards 13 antibiotic treatments. Commonly all these bacteria have developed resistant towards Spectinomycin (Figure 5.4, Table 5.3). One-way ANOVA indicates no significant variation in antibiotic resistance profiles across sampling locations ($p>0.05$).

Table 5.3 Antibiotic resistance in Malaysian Borneo bats regarding bat species, bacteria species, antibiotic resistance, and its resistance gene

Bat species	Family	Pathogenic bacteria harboured	Resistance to	Location of resistance gene mutation
Balionycteris maculata	Pteropodidae	*Borrelia burgdorferi*	Kanamycin	16s rRNA
		Escherichia coli	Edeine, G418, Gentamicin C, Kasugamicin, Spectinomycin, Streptomycin, Tetracycline	16S rRNA, rrsB, rrsC, rrnB
		Helicobacter pylori	Tetracycline	16S rRNA
		Mycobacterium smegmatis	Hygromycin B	rrsB
		Pasteurella multocida	Spectinomycin	16s rRNA
		Salmonella enterica	Spectinomycin	rrsD
Cynopterus brachyotis	Pteropodidae	*Escherichia coli*	Gentamicin C, Kasugamicin, Neomycin, Spectinomycin, Streptomycin, Tetracycline, Tobramycin	rrsB, rrsC, rrnB, 16s rRNA
		Helicobacter pylori	Tetracycline	16s rRNA
		Pasteurella multocida	Spectinomycin	16S rRNA
		Salmonella enterica	Spectinomycin	rrnB

Dyacopterus spadiceus	Pteropodidae	*Escherichia coli*	Edeine, G418, Gentamicin C, Kanamycin A, Kasugamicin, Neomycin, Paromomycin, Spectinomycin, Streptomycin, Tetracycline, Tobramycin	rrsB, rrnB, rrsC, 16s rRNA, rrsH
		Pasteurella multocida	Spectinomycin	rrsH
		Salmonella enterica	Spectinomycin	rrsH
Macroglossus minimus	Pteropodidae	*Escherichia coli*	Edeine, G418, Gentamicin C, Kanamycin A, Kasugamicin, Neomycin, Paromomycin, Spectinomycin, Streptomycin, Tetracycline, Tobramycin	16S rRNA, rrnB, rrsB, rrsC
		Helicobacter pylori	Tetracycline	16S rRNA
		Neisseria meningitidis	Spectinomycin	16S rRNA
		Pasteurella multocida	Spectinomycin	rrnB, 16s rRNA
Rhinolophus affinis	Rhinolophidae	*Escherichia coli*	Edeine, G418, Gentamicin, Kanamycin, Neomycin, Paromomycin, Spectinomycin, Streptomycin, Tetracycline, Tobramycin	16S rRNA, rrnB, rrsB

Rhinolophus philippinensis	Rhinolophidae	*Escherichia coli*	Edeine, G418, Gentamicin C, Kanamycin A, Kasugamicin, Neomycin, Paromomycin, Spectinomycin, Streptomycin, Tetracycline, Tobramycin	16S rRNA rrnB, rrsB, rrsC, rrsH
		Pasteurella multocida	Spectinomycin	16S rRNA
		Salmonella enterica	Spectinomycin	rrsD
		Pasteurella multocida	Spectinomycin	16S rRNA
Rhinolophus sedulus	Rhinolophidae	*Borrelia burgdorferi*	Spectinomycin	16S rRNA
		Escherichia coli	Edeine, G418, Gentamicin C, Kanamycin A, Kasugamicin, Neomycin, Paromomycin, Spectinomycin, Streptomycin, Tetracycline, Tobramycin	16S rRNA, rrnB, rrsB, rrsC, rrsH
		Salmonella enterica	Spectinomycin	rrsD
Rhinolophus trifoliatus	Rhinolophidae	*Escherichia coli*	Edeine, G418, Gentamicin C, Kanamycin A, Kasugamicin, Neomycin, Paromomycin, Spectinomycin, Streptomycin, Tetracycline, Tobramycin	16S rRNA, rrsB, rrnB, rrsC, rrsH
		Salmonella enterica	Spectinomycin	rrsD

Glischropus tylophus	Vespertillionid-ae	*Escherichia coli*	Edeine, G418, Gentamicin C, Kanamycin A, Kasugamicin, Neomycin, Paromomycin, Spectinomycin, Streptomycin, Tetracycline, Tobramycin	16S rRNA, rrnB, rrsB, rrsC, rrsH, rrsD
		Helicobacter pylori	Tetracycline	16S rRNA, rrnB
		Pasteurella multocida	Spectinomycin	16S rRNA, rrnB, rrsD
		Salmonella enterica	Spectinomycin	rrsD, rrnB
Kerivoula hardwickii	Vespertillioni-dae	*Escherichia coli*	Edeine, G418, Gentamicin C, Kanamycin A, Kasugamicin, Neomycin, Paromomycin, Spectinomycin, Streptomycin, Tetracycline	16S rRNA, rrsB, rrsC, rrsH, rrnB
		Salmonella enterica	Spectinomycin	rrsH
Kerivoula minuta	Vespertillioni-dae	*Escherichia coli*	Edeine, G418, Gentamicin C, Kanamycin A, Kasugamicin, Neomycin, Paromomycin, Spectinomycin, Streptomycin, Tetracycline, Tobramycin	16S rRNA, rrsB, rrsC, rrsH, rrnB
		Salmonella enterica	Spectinomycin	rrsD
Myotis muricola	Vespertillionid-ae	*Escherichia coli*	Spectinomycin	rrsH

Myotis ridleyi	Vespertillionid-ae	*Borrelia burgdorferi*	Kanamycin	rrsB
		Escherichia coli	Edeine, G418, Gentamicin, Kanamycin, Kasugamicin, Neomycin, Paromomycin, Spectinomycin, Streptomycin, Tetracycline, Tobramycin	16S rRNA, rrnB, rrsB, rrsC, rrsD
		Mycobacterium tuberculosis	Streptomycin, Viomycin	16S rRNA, rrnB
		Pasteurella multocida	Spectinomycin	rrsD
		Salmonella enterica	Spectinomycin	rrsD
Tylonycteris pachypus	Vespertillionid-ae	*Borrelia burgdorferi*	Gentamicin	16s rRNA
		Escherichia coli	Edeine, G418, Gentamicin, Kanamycin, Kasugamicin, Neomycin, Paromomycin, Spectinomycin, Spectinomycin C, Streptomycin, Tetracycline, Tetracycline A, Tobramycin	16s rRNA, rrnB, rrsB, rrsC

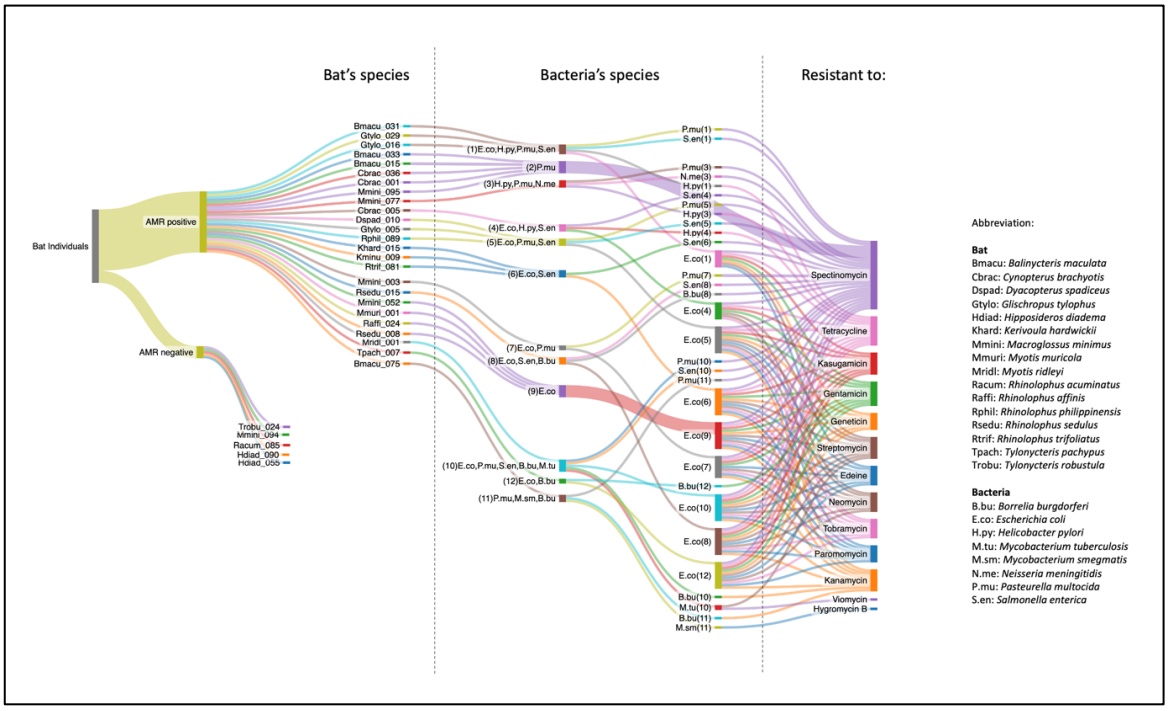


Figure 5.4: The Sankey diagram showing the bat species and their respective harbored pathogenic bacteria with antimicrobial resistance properties. The thickness of the lines indicates the number of relationships. The number in the bracket shows the grouping of bacteria based on common bats host.

5.3 Discussion

Pathogenic and opportunistic bacteria of bats; the public health perspectives

Bats of Malaysian Borneo proved to harbor numerous bacteria species. Their wide range of diet, interaction with other wild animals, environmental exposure, migration, and movement makes them the ideal host for wide range of bacterial species, non-pathogenic, opportunistic, and pathogenic strains. Non-pathogenic, pathogenic, and opportunistic bacteria all have different traits and ways of behaving based on their ability to make the hosts sick. Non-pathogenic bacteria are usually harmless. They are often live-in harmony with

their hosts and may even be helpful, like helping with digestion or making vitamins that the body needs (Yadav et al., 2023). Pathogenic bacteria, on the other hand, have developed ways to actively attack, colonise, and harm their hosts. This can lead to a wide range of diseases, from mild to serious (Jones & Walker, 2019; Letko et al., 2020; Hoyt et al., 2021; Szentivanyi et al., 2023). Even though opportunistic bacteria are usually safe, they can use vulnerabilities like weakened immune systems or changes in the host's environment to cause illnesses (Smith & Johnson, 2018). The bacteria species reported here is both opportunistic and pathogenic bacteria (CDC, 2023).

The detection of *Bartonella* sp. in *Glischropus tylophus*, *Macroglossus minimus*, *Rhinolophus acuminatus* and *Rhinolophus philippinensis* should not be overlooked although occurring at low frequencies, due to the zoonotic nature of this bacterium. *Bartonella* spp. are well-known to cause bartonellosis, a bacterial infection that poses growing concern for public health worldwide (Eremeeva et al., 2007). These Gram-negative bacteria are typically transmitted through blood-feeding arthropods and have been found in various mammals, including bats, livestock, and rodents (Bai et al., 2011; Veikkolainen et al., 2014; Lei and Olival, 2014). The ability of bats to harbor *Bartonella* spp. raises significant implications for zoonotic spillover, as contact with infected bats or their ectoparasites could lead to human exposure. While the occurrence of *Bartonella* in the bat species in the sample set was relatively low, it highlights the need for ongoing monitoring and research into the role of bats as potential reservoirs for zoonotic pathogens, especially in areas with frequent human-bat interactions.

Rhinolophus sedulus was detected to host the highest number of *Lactococcus lactis*, which can be reflected through its insectivorous diet. Molina et al., 2022 reported that in their study, among all lactic acid bacteria group, *L. lactis* was the most widespread species

in all insect species. Although *L. lactis* is usually considered to be non-pathogenic in humans, cases of infective endocarditis have been reported (Aguado et al., 2016; Chen et al., 2018; Lepczyńska et al., 2019; CDC, 2023). Five major genera of opportunistic and pathogenic bacteria that were detected in bats of Malaysian Borneo were *Escherichia* spp., *Lactococcus* spp., *Enterococcus* spp., *Citrobacter* spp. and *Shigella* spp. It is essential to note that composition of microbial communities can be quite diverse and dynamic, thus gaining a comprehensive understanding of each of these bacterial strains may provide a more informed view on their potential impact on public health.

Escherichia coli is a bacterium that has many different strains, some of which are of public health interest. For example, Enterohemorrhagic *E. coli* (EHEC) causes serious cases of bloody diarrhoea and can lead to haemolytic uremic syndrome (HUS) (Smith et al., 2019; Mengistu & Mengesha, 2023). Enterotoxigenic *E. coli* (ETEC) is a major cause of traveller's diarrhoea and makes both heat-labile and heat-stable enterotoxins (Khalil et al., 2019; Aminian et al., 2023). The last strain is Enteropathogenic *E. coli* (EPEC) mostly affects babies and causes diarrhoea by causing ulcers to stick to and peel off the intestines (Khalil et al., 2019; Hassan et al., 2021). *Escherichia fergusonii* is another type of *Escherichia*, but not as much is known about how dangerous it is. Even though *E. fergusonii* is thought to be less dangerous than *E. coli*, some forms of it have been linked to opportunistic infections in people, such as urinary tract infections (Baek et al., 2019; Choi et al., 2023). Besides, *E. albertii* is another member of the group that hasn't been studied as much as *E. fergusonii*. It has been found in different parts of the world and in the guts of animals. Even though not much is known about how dangerous *E. albertii* is, it has been linked to a small number of human diseases (Ooka et al., 2012; Gomes et al., 2020).

Lactococcus lactis is mostly known for its important part in the fermentation of milk, but it can sometimes show opportunistic infectious traits (Lepczyńska & Dzika, 2019). Even though it's mostly thought to be harmless, some types have been linked to rare infections, especially in people with weak immune systems or conditions that make them more likely to get sick. Most of the time, these illnesses is mild, but endocarditis and bacteremia can happen (Zechini et al., 2006; Chen et al., 2018; Lepczyńska & Dzika, 2019). *Lactococcus garvieae*, on the other hand, is a bacterium that lives mostly in water. It is known for causing lactococcosis in fish, which leads to a lot of illnesses and fatalities in aquaculture (Eldar & Ghittino, 1999; Shi et al., 2023). Even though it happens rarely, *L. garvieae* can cause illnesses in humans, like endocarditis or septicemia, mostly in people who already have health problems (Fihman et al., 2006; Francés-Cuesta et al., 2023).

There are many pathogenic species in the *Enterococcus* genera which in this study, 15 pathogenic species were detected. These includes the most prominent pathogenic bacteria in clinical setting, *E. faecalis*. *Enterococcus faecalis* had been reported to cause diseases like urinary tract infections, bacteremia, and infective endocarditis (Arias & Murray, 2012; Bhardwaj et al., 2019; Dahl et al., 2019). *Enterococcus avium* has been linked to infections, especially in people who don't have strong immune systems. It can cause bacteremia and urinary tract infections (Na et al., 2012; Abo-Zed et al., 2022). Tedim et al., 2017 reported that *E. gallinarum* is known to cause opportunistic illnesses like bacteremia and urinary tract infections. *Enterococcus casseliflavus* is known for being resistant to vancomycin, and diseases like bacteremia and endocarditis have been linked to it (Choi et al., 2004; Monticelli et al., 2018). Even though it happens less often, *Enterococcus durans* has also been linked to infections, such as urinary tract infections and endocarditis (Atanasove et al., 2014;

Sunbul et al., 2018; Radovanovic et al., 2022). In summary, *Enterococcus* is a diverse genus, some of whose species exhibit varying degrees of pathogenicity.

Citrobacter is another genus that has many species. Some of these species are harmful to people and can cause a wide range of illnesses. *Citrobacter freundii*, a well-known species in the genus, can act as an opportunistic pathogen and cause illnesses like urinary tract infections and lung tract infections (O'Hara et al., 2000; Samonis et al., 2009; Lewicki et al., 2021). *Citrobacter koseri* is another dangerous species that can cause major illnesses, especially in newborns and people with weak immune systems, leading to conditions like infant meningitis (Prais et al., 2003; Martínez-Lage et al., 2010; Marecos et al., 2012). Even though *Citrobacter* species are less common as human diseases, it's important to know that they can cause infections, especially in people who are weak or sick.

Shigella spp. has several harmful species that are known to cause shigellosis, which is a major public health problem around the world (Schnupf & Sansonetti, 2019; Bennish & Ahmed, 2020). *Shigella sonnei* is the most common species in developed countries and is the cause of many cases of mild to moderate diarrhoea (Schnupf & Sansonetti, 2019; Bennish & Ahmed, 2020; Tosisa et al., 2020). *Shigella flexneri* is common in places that are still developing. It causes bloody diarrhoea and serious sickness, especially in kids (Faruque et al., 1998; Herwana et al., 2010; Nisa et al., 2020). *Shigella dysenteriae* and *Shigella boydii* is uncommon, and both could cause symptoms like diarrhea, fever, nausea and vomiting (Bennish et al., 1990; Dutta et al., 2003; Von Seidlein et al., 2006; Jain et al., 2020).

The influence of bat's physiology and ecology on pathogenic bacteria community

There are several factors that were studied to check on their influence towards the presence of pathogenic bacteria community in bats. Previous studies have shown a correlation between the microbial composition found in bat species and many parameters, including its diet (Carrillo-Araujo et al., 2015), habitat (Ingala et al., 2018), and phylogenetic relationships (Xue et al., 2015). In addition to that, this study also tested the gender factor. Significant difference was detected between the different groups of diet and between different bat's family (Figure 5.3).

The significant difference was observed for the insect eating (insectivorous) and plant-based eating bats (frugivorous & nectarivorous). This reflects the concept that dietary habit significantly influences the composition and structure of the gastrointestinal microbiota in animals (Carrillo-Araujo et al., 2015; Brooks et al., 2018). Statistically, significant difference in terms of bacteria composition was detected between Hipposideridae – Pteropodidae, Hipposideridae – Vespertilionidae and Vespertilionidae – Rhinolophidae. The variations in pathogenic bacteria composition across bat families may be attributed to the genetic characteristics and evolutionary processes of the host organisms.

The heritability of certain bacterial strains within bat lineages may be influenced by genetic variables, hence influencing the microbial diversity of bats (Ingala et al., 2018; Gong et al., 2021). The process of evolutionary divergence across various bats families is believed to have resulted in the development of unique microbiological adaptations. The coevolutionary relationship between bats and their microbiota trigger the interactions that play a role in shaping the variations of pathogenic bacteria (Xue et al., 2015; Gong et al., 2021). Distinct microenvironments may result from variations in digestive transit time, pH,

and enzyme secretion; these microenvironments may promote the growth of bacterial taxa that have adapted to the conditions (Muegge et al., 2011).

The impact of gender and habitat type on bacterial composition in bats may vary depending on the context. The lack of significant difference seen in this study is consistent with the report from previous studies, where Yatsunenko et al., 2012 reported while gender might influence certain aspects of the gut microbiome, its impact may be less prominent. Study by Ingala et al., 2018 on wild mammals highlight that while the habitat type does potentially have an impact on the host's microbiome composition, careful consideration of the sampling approach is needed. In this study's case, a bigger sample set with a wider habitat type could possibly provide a better resolution to the pathogenic bacteria composition in bats.

The dynamic of bacteria coinfections in bats

Co-infections involving pathogenic bacteria and mammals have been a subject of extensive research due to their significant implications for both public health and evolutionary biology (Eidelman et al., 2019; Abbate et al., 2020; Porcelli et al., 2022; Lane et al., 2023). When a bat harbors multiple pathogenic bacterium, the situation becomes complex, and the potential risks associated with spillover to humans can be significant. The co-infection of pathogenic bacteria can occur through various mechanisms, including vector-borne transmission, environmental exposure, and direct contact (Gross et al., 2000; Pritt et al., 2016; Post et al., 2019).

This study reported the *Rhinolophus sedulus* and *Tylonycteris pachypus* to have the highest coinfection of pathogenic bacteria species, while the least coinfection is between *Hipposideros diadema* and *Balionycteris maculata*. Investigating the fundamental principles

of the bacterial co-existence inside the bat's microbiome is challenging due to its complexity. However, the question on how the bats can acquire and host multiple pathogenic bacteria can be answered by studying various aspects of their physiology and ecological factors (Mühldorfer, 2013; Gong et al., 2021). These bacteria may have co-evolved with bats, often remaining asymptomatic within the bat host due to a coexistence between the bacteria and the bat's immune system (McKee et al., 2021).

Bats exhibit physiological adaptations that enable them to coexist with diverse bacteria. Their elevated body temperatures, often associated with flight, can serve as a barrier to certain bacterial pathogens (Brook & Dobson, 2015; Ingala et al., 2018). Additionally, their unique immune systems may play a role in tolerating or controlling bacterial infections without developing clinical symptoms (Brook & Dobson, 2015; Banerjee et al., 2020). Bats frequently congregate in large colonies within roosts, where they engage in close social interactions (Rosli et al., 2018; Egret-Berg et al., 2021). Although this may be applicable to all the cave dwelling bats, such instance is not possible in species that roost in forest such as *Tylonycteris pachypus*. Therefore, it also possible that this bat species harbor microbe independently through their interactions with the environment.

Bats have varied dietary preferences, including insectivorous, frugivorous, and nectarivorous species (Cruz-Neto et al., 2001; Morni et al., 2016; Egert-Berg et al., 2021). These dietary differences expose bats to different environmental niches and may contribute to the diversity of bacteria they encounter and host. Bats often interact with other wildlife species, such as birds and arthropods, in shared habitats (Olival et al., 2017; Cohen & Satterfield, 2020; Jägerbrand & Spoelstra, 2023). These interactions offer opportunities for

bacteria to transfer between different host species, potentially enriching the bacterial diversity within bat populations.

The risk of spillover of these coinfection bacterial pathogens from bats to humans can be significant. It's important to note that most bat-associated bacteria may not directly infect humans. However, under specific circumstances, exposure can occur, particularly through contact with bat excreta, bites, or consumption of bat meat (Turmelle & Olivial, 2009; Ramanantsalama et al., 2022; Schloesing et al., 2023). This risk is further exacerbated when humans encroach on bat habitats or handle bats in proximity, potentially facilitating zoonotic transmission events (Han et al., 2015; Dutheil et al., 2021).

Antibiotic resistance bacteria in wild bats

A total of 30 individuals from 16 species of bats were tested for antibiotic resistance. 25 individuals (83%) detected to harbour bacteria with antibiotic properties. A big portion of the pathogenic bacteria detected to be resistance towards Spectinomycin. This is tally with previous studies that had reported the presence of antimicrobial resistance bacteria towards this broad-spectrum antibiotic (Schwinghamer & Dudman, 1973; Ison et al., 1983; Galimand et al., 2000; Ilina et al., 2013; Riedel et al., 2019; Yu et al., 2022).

Interestingly, five individuals (17%) consisting *Tylonycteris robustula* (n=1), *Macroglossus minimus* (n=1), *Rhinolophus acuminatus* (n=1) and *Hipposideros diadema* (n=2) showed no detection of AMR bacteria in their gut microbiome. Considering factors such as their sampling locality, ecology and systematics (Warnecke et al., 2012; Monahan et al., 2021; Jia et al., 2022), no definitive conclusion can be made as other individuals of the same species and family were detected to harbor AMR bacteria in this study.

Nevertheless, a notable point is on two individuals of *Hipposideros diadema*, that both does not harbor AMR bacteria. This needed to be treated with caution due to small sample size.

Generally, bats have emerged as significant reservoirs of antibiotic-resistant bacteria, posing potential public health concerns (Foti et al., 2023). Bats, with their diverse ecological niches and wide geographic distribution, can harbor a range of bacteria, some of which have developed resistance to antibiotics (Kuzmin et al., 2011; Wang et al., 2011; Letko et al., 2020; Hoyt et al., 2021; Szentivanyi et al., 2023). This phenomenon reflects the complex interplay between wildlife, their environments, and the broader microbial ecology.

One contributing factor to antibiotic resistance in wildlife may be the presence of antibiotics in the environment. Studies have detected antibiotic residues in water bodies, soils, and agricultural runoff, which can potentially expose wild animals to these drugs (Larsson, 2014; Monahan et al., 2021; Jia et al., 2022). This can create selective pressure for the development of antibiotic resistance in the wild. Resistant bacteria can thrive and spread in environments contaminated with sublethal concentrations of antibiotics (Pruden et al., 2006).

Wildlife can be exposed to antibiotics indirectly through their interactions with humans and anthropogenic activities. Bats, for instance, may roost in buildings or structures near human populations, where they can encounter antibiotic-resistant bacteria present in the environment (Warnecke et al., 2012; Monahan et al., 2021; Jia et al., 2022). Additionally, bats and other wildlife may consume insects or feed on plants that have been exposed to antibiotics, serving as potential routes of transmission of antibiotic resistance (Allen et al., 2010; Vandeweyer et al., 2019).

The spill over of antibiotic resistance bacteria towards human population are very concerning as this “superbugs” could affect human in various ways. The antibiotic that previously effective could be no longer efficient to control the bacterial infections. To put things into perspective, if *E. coli*, *P. multocida* and *S. enterica* from *B. maculata* in this study accidentally spilled over towards human population, treatment using Spectinomycin would not work (Table 5.3). The presence of this constraint in the available treatments might lead to extended durations of diseases, escalated healthcare expenditures, and, in some instances, the absence of treatment choices (CDC, 2023). Higher mortality rates in cases of antibiotic-resistance bacteria were also reported as compared to susceptible bacteria (Magiorakos et al., 2012).

The rise of antibiotic-resistant microorganisms poses a substantial financial strain on healthcare systems and communities. According to O'Neill, 2016, the expenses associated with managing illnesses caused by antibiotic-resistant bacteria are significantly elevated because of prolonged hospitalisations, the use of specialised treatments, and the need for supplementary diagnostic examinations. An early preventive measure would be critical to avoid possible spill-over.

5.4 Conclusions

The unique physiological adaptations, roosting behaviours, dietary preferences, and interactions with other species shown by bats contribute significantly to their ability to serve as natural reservoirs for various pathogenic bacteria. This poses interesting challenges for the fields of disease ecology and public health. The influence of diet and phylogeny on the composition of the bat microbiome seems to be significant, however other variables like as

geographical variation, gender, and sampling approaches need be considered in order to have a comprehensive understanding. The occurrence of co-infections in mammals, when several pathogenic bacteria are present, is a complex and diverse phenomenon. Co-infections can occur via several routes, including vector-borne transmission, environmental exposure, and direct contact. Gaining insight into the complex mechanisms of antibiotic resistance in bats and their associated microbiota is vital to fully grasp the larger perspective of One Health.

This perspective considers the complex relationship of human, animal, and environmental well-being, highlighting the need to adopt a holistic approach to address the issue of antibiotic resistance in both clinical and wildlife contexts. This highlights the significance of ongoing research and surveillance efforts aimed at monitoring the emergence and spread of antibiotic-resistant bacteria in wildlife species such as bats. The exact contributions of anthropogenic activities to wildlife antibiotic resistance are complex and multifactorial, but proper antibiotic disposal and minimizing environmental contamination are key to mitigate its spread. The collaboration and interdisciplinary approach among ecologists, microbiologists, and public health specialists play a crucial role in tackling those complex challenges and mitigating the potential hazards linked to bacterial infections associated with bats. This study highlights the complex relationship between bats and pathogenic bacteria, underscoring the need of using a multidisciplinary methodology to gain a better understanding of disease dynamics within bat populations.

CHAPTER 6

DE-NOVO TRANSCRIPTOME ASSEMBLY AND FUNCTIONAL ANNOTATION OF BATS DIET IN BORNEO

6.1 Introduction

Bats are remarkable animals, having a global population of about 1469 species (Simmons & Cirranello, 2024). They play a crucial role in preserving an ecological equilibrium by carrying out vital tasks including pollination, seed dissemination, and pest control (Kunz et al., 2011; Ramírez-fráncel et al., 2022). They demonstrate evolutionary adaptability with unique features including flying, echolocation, hibernation, resilient immune systems and varied diet preferences (Buckles, 2015; Serra-Cobo & Lopez-Roig, 2017; Santillan et al., 2021; Power et al., 2022). Advancements in next generation sequencing have enabled the comprehensive analysis of the whole genome and transcriptome of bat species, leading to enhanced insights into their evolutionary processes (Moreno-Santillan et al., 2019).

To understand the gene expressions expressed in their numerous unique adaptations, transcriptomes of various bat organs and tissues have been sequenced and assembled including brain (Lei et al., 2014; Lee et al., 2015), heart (Lee at al., 2015), kidney (Shaw et al., 2012; Lee et al., 2015), liver (Lee et al., 2015), lung (Shaw et al., 2012; Lee et al., 2015), lymph (Lee et al., 2015), spleen (Papenfuss et al., 2012; Shaw et al., 2012; Lee et al., 2015;), thymus (Papenfuss et al., 2012), blood (Huang et al., 2016), wing biopsies (Foley et al., 2018) and salivary gland (Phillips et al., 2014; Vandewege et al., 2019; Vandewege et al., 2020).

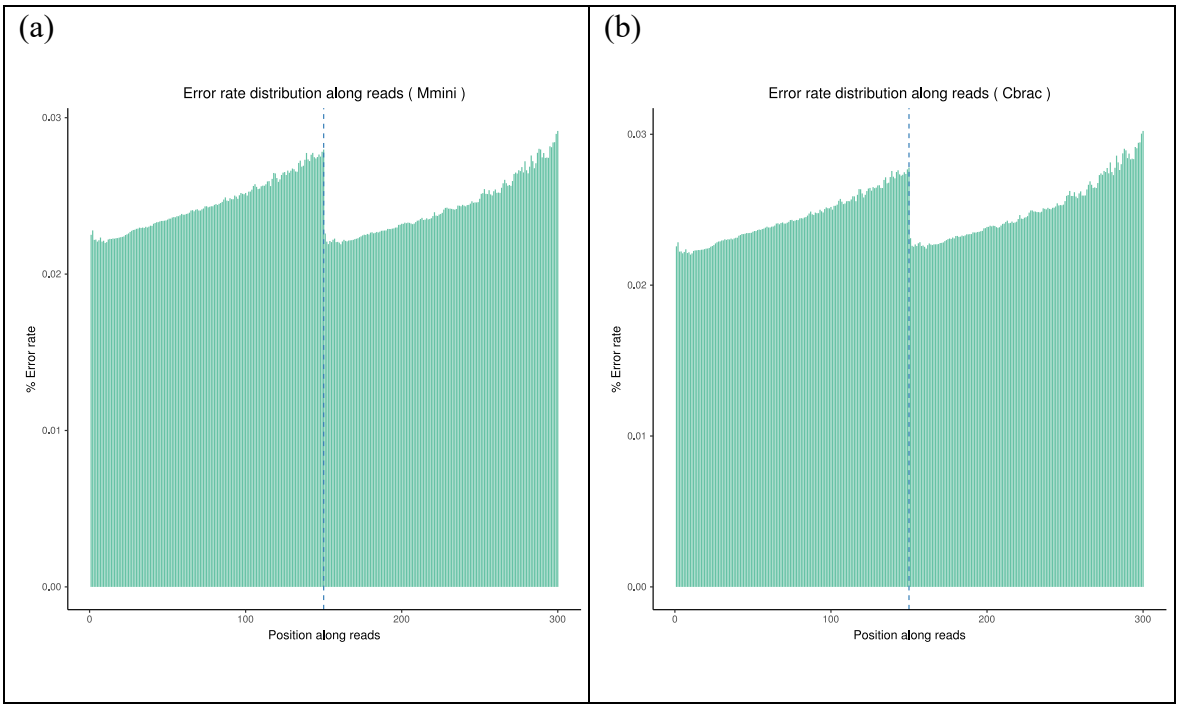
The bat's dietary preferences are one of the interest for bat's transcriptomics studies. Phillips et al. 2014 reported that *Myotis lucifugus* are capable of processing exogenous lipids from their insect diet during foraging for the flight expenditure, while Gutiérrez-Guerrero et al., 2020 reported that blood feeding bat, *Desmodus rotundus* expressed traits of coagulation mechanism, and the nectarivore species *Leptonycteris yerbabuenae, L. nivalis* and *Musonycteris harrisoni* expressed a group of positively selected genes that involve in sugar, lipid and iron metabolism. The understanding of bat dietary preferences is crucial for understanding their ecological importance, since their varied diets have an immediate effect on ecosystem dynamics (Kasso & Balakrishnan, 2013; Vesterinen et al., 2016).

Previous transcriptomic studies outside of Borneo (e.g. Phillips et al., 2014; Gutiérrez-Guerrero et al., 2020) have emphasised the extraordinary ability of bats at utilising various food sources, leading the interest on understanding the genetic adaptations responsible for their dietary specialisation. However, such studies are lacking, especially in the context of the bat populations in Borneo. This study interested in the transcriptomic study of the Bornean bats, aiming to (1) report the highly expressed genes of bats and (2) categorize the bats based on their dietary preferences into three groups: frugivorous, nectarivorous, and insectivorous. Then, analyse and discuss the genes that are significantly expressed between group and the pathways that show the highest enrichment related to their dietary habits. The findings reported here will help in establishing a fundamental understanding on the transcriptomic study of bats in Borneo.

6.2 Results

Transcriptome sequencing, reference assembly and correlation analysis

The mRNA sequencing from six bat individuals generated a total of 257,900,428 raw reads. Each individual sample underwent individual error rate testing, with all six samples successfully passing the test, exhibiting an average error rate of 0.024, well below the 1% threshold (Figure 6.1)



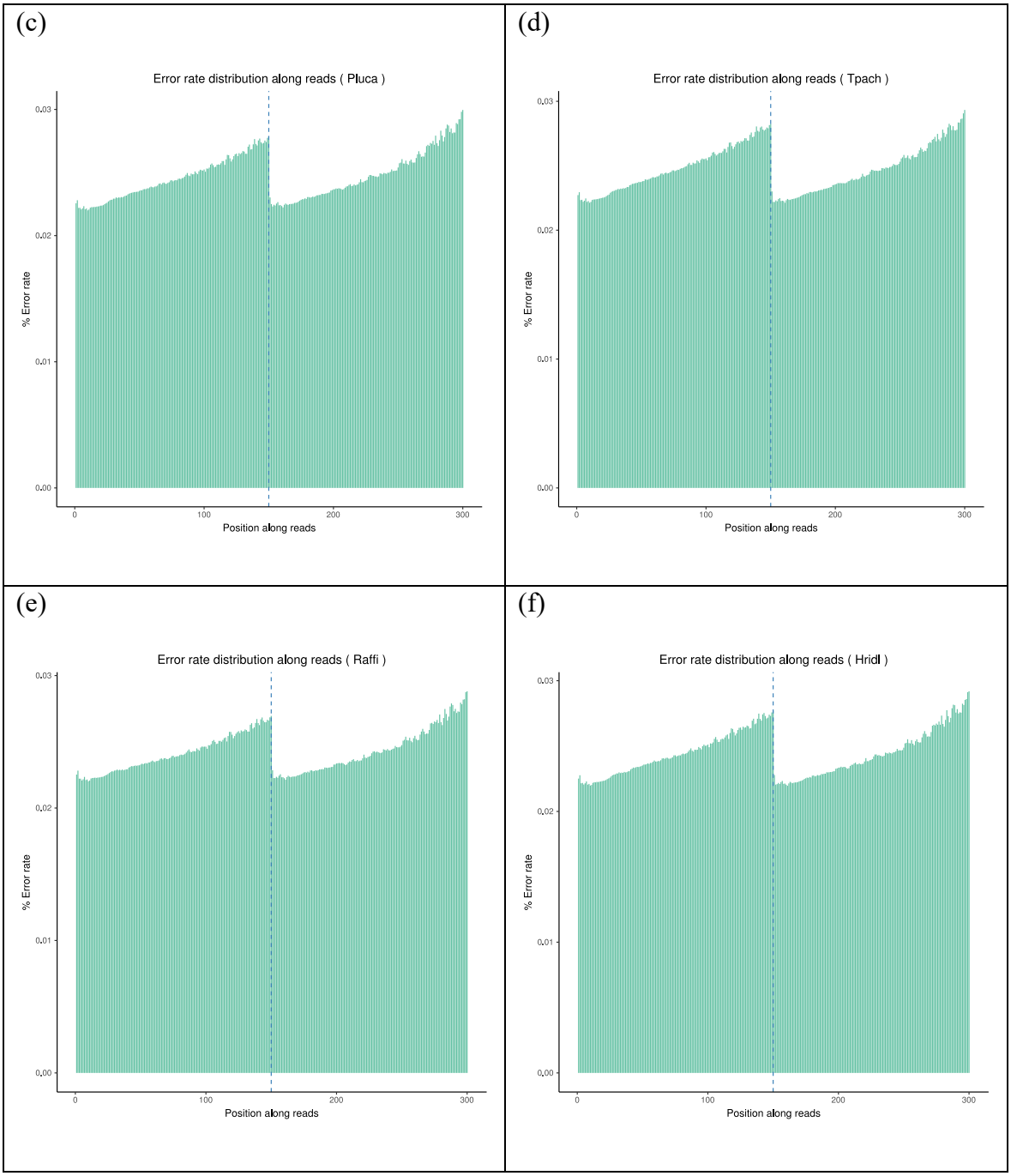


Figure 6.1: The graph of error rate distribution along read for all six samples. The species abbreviations follow Table 3.2.

Following the exclusion of reads containing adaptors, those with more than 10% uncertain nucleotide substitutes (N) and reads with a Qscore of under 5 for over 50% of their bases, all six bat individuals maintained a minimum of 96.84% of their initial raw sequences. A comprehensive summary of the data quality control outcomes is presented in Table 6.1.

Table 6.1: Summary of data quality control outcomes for all six samples

Species (Diet)	Raw reads	Containing N	Adapter related	Clean reads
Cynopterus brachyotis (Frugivorous)	42,278,877	75 (0.00%)	1,356,325 (3.16%)	41,567,001 (96.84%)
Penthetor lucasi (Frugivorous)	43,047,943	87 (0.00%)	1,197,383 (2.78%)	41,850,473 (97.22%)
Macroglossus minimus (Nectarivorous)	41,467,488	77 (0.00%)	922,496 (2.13%)	42,411,857 (97.87%)
Hipposideros ridleyi (Insectivorous)	42,923,401	87 (0.00%)	1,197,383 (2.24%)	41,329,966 (97.76%)
Rhinolophus affinis (Insectivorous)	43,334,430	63 (0.00%)	1,305,892 (3.15%)	40,161,533 (96.85%)
Tylonycteris pachypus (Insectivorous)	44,848,289	73 (0.00%)	779,208 (1.74%)	44,069,007 (98.26%)

Clean reads were de novo assembled and yielded an extensive dataset comprising a total of 474,166 transcripts and 199,019 Unigenes. Notably, the quality, accuracy, and integrity of the splicing outcomes were confirmed through a comprehensive BUSCO evaluation, as illustrated in Figure 6.2.

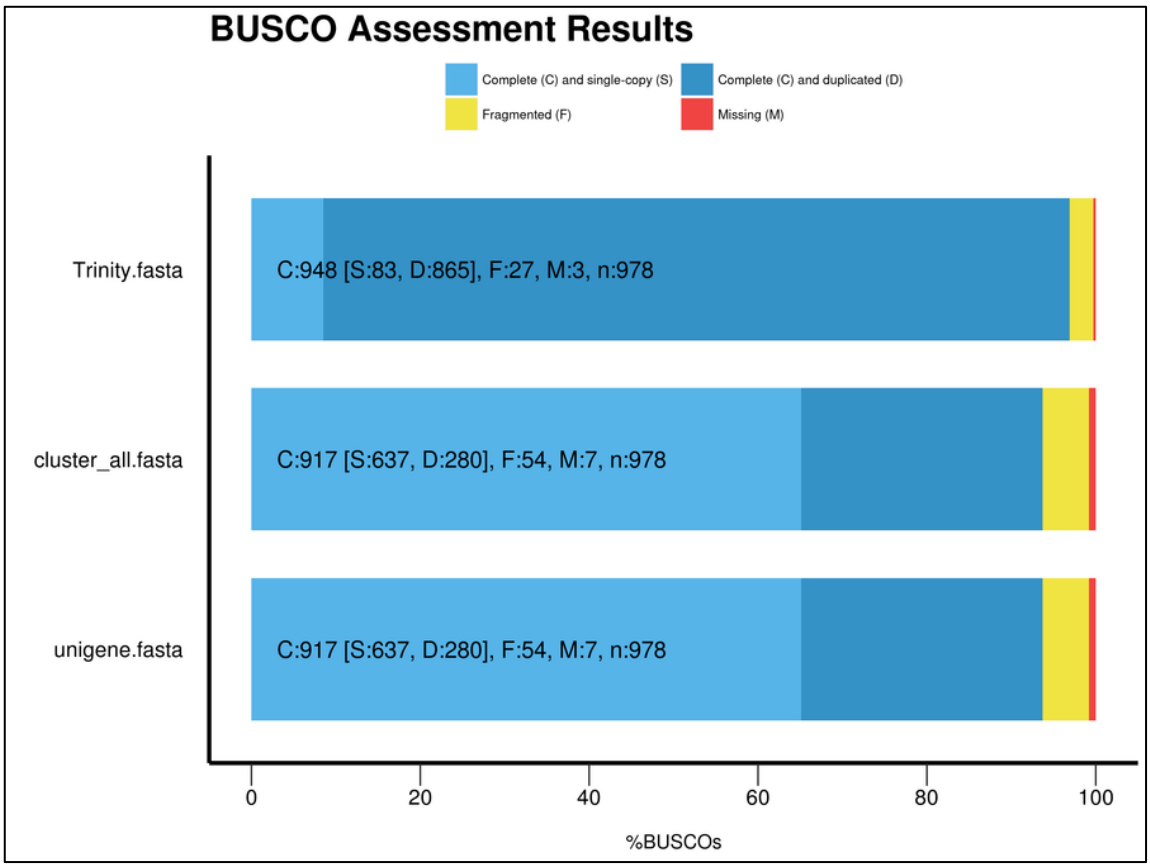


Figure 6.2: The benchmarking universal single-copy orthologs (BUSCO) assessment results

The de novo transcriptome alignment for all six bat individuals was performed to facilitate comparisons between different dietary groups. Mapping was conducted against a reference set of mammalian genes to identify and quantify gene expression levels. Among the species analyzed, *Rhinolophus affinis* demonstrated the highest mapping rate at 75.87%, while *Cynopterus brachyotis* displayed the lowest at 70.17%. (Table 6.2). Analysis of Fragments Per Kilobase of transcript sequence per Millions base pairs sequenced (FPKM) revealed relatively consistent gene expression levels across frugivorous, nectarivorous, and insectivorous bats (Figure 6.3).

Table 6.2: The mapping rate for all six samples

Species	Dietary Preference	Total Reads	Total Mapped
Penthetor lucasi	Phytophagous	41850473	30206192(72.18%)
Hipposideros ridleyi	Insectivorous	41329966	30676129(74.22%)
Rhinolophus affinis	Insectivorous	40161533	30468862(75.87%)
Cynopterus brachyotis	Phytophagous	41567001	29168925(70.17%)
Macroglossus minimus	Phytophagous	42411857	30416507(71.72%)
Tylonycteris pachypus	Insectivorous	44069007	32787666(74.40%)

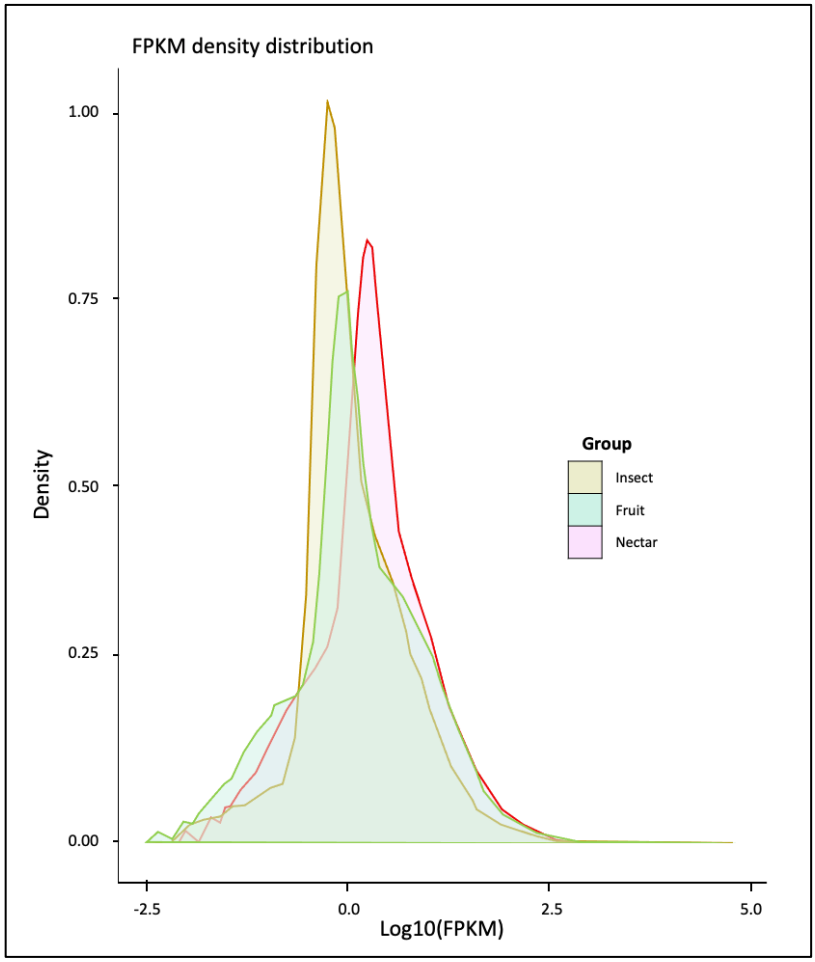


Figure 6.3: The fragments per kilobase of transcript sequence per millions base pairs sequenced (FPKM) analysis based on three group of bat's diet preferences.

Correlation analysis

The Pearson correlation analysis revealed noticeable correlations, although not particularly strong, still indicative of an apparent pattern of correlation among bats with similar dietary preferences. This was evident in the correlation between species with plant-based diets, such as *Penthetor lucasi* (frugivorous), which showed correlations with *Cynopterus brachyot*is (frugivorous) (R^2=0.28) and *Macroglossus minimus* (nectarivorous) (R^2=0.14). A similar pattern was observed among insectivorous bats, exemplified by *Hipposideros diadema* and *Rhinolophus affinis* (R^2=0.08). Notably, the bamboo bat *Tylonycteris pachypus* exhibited no similarities with the other five bat species (Figure 6.4). This may due to differences in habitat or foraging behavior of the bamboo bats that result in distinct microbial communities and gene expressions.

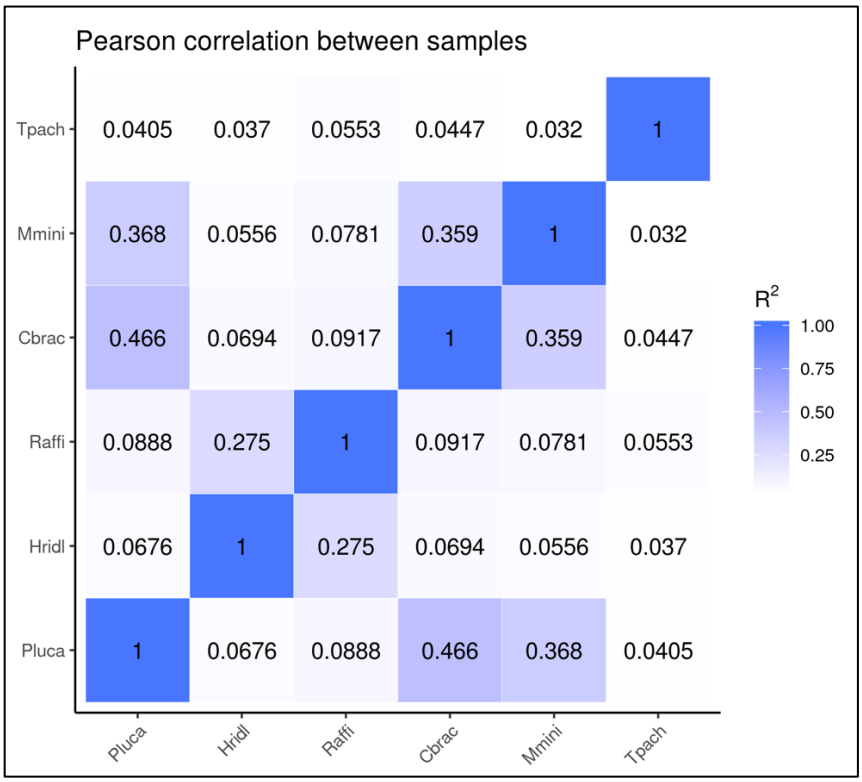


Figure 6.4: The Pearson correlation between all six samples. The species abbreviations follow Table 3.2.

Cluster analysis

The cluster analysis was used to find genes with similar expression pattern, cluster them and assigned these clusters to different colors. Genes within each cluster have similar functions or take part in the same biological processes. This analysis showed a distinct grouping based on the bat's diet preferences, with plant-based diet (frugivorous and nectarivorous) clustered within one sister clade, branched out from the insect-based diet bats (Figure 6.5).

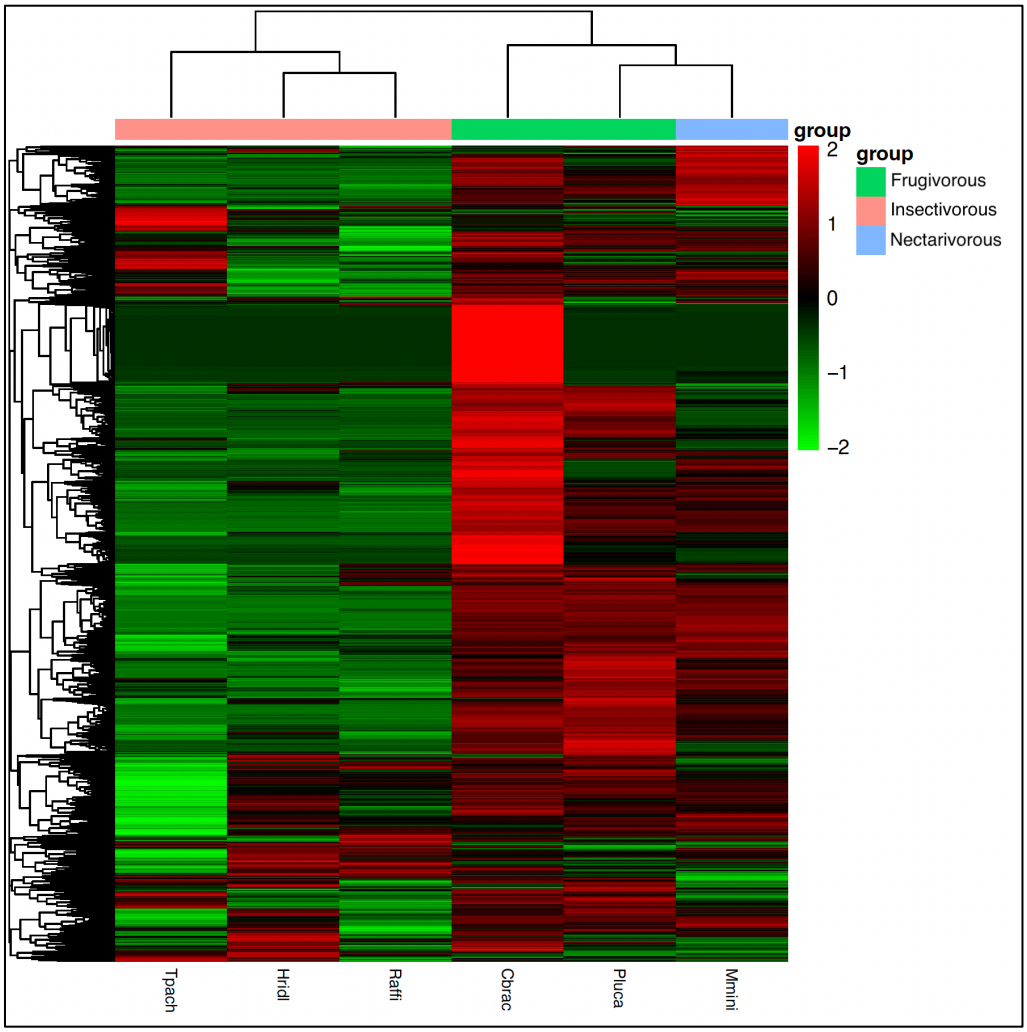


Figure 6.5: The dendogram of cluster analysis based on similarity in functional biological processes. The species abbreviations follow Table 3.2.

Differential expression gene between plant-based and insect-based diet

The differential expression gene analysis was used to find the genes that exhibit significant changes in their expression levels between different dietary group. Host gene expression was distinguished from bacterial gene expression by referencing the full genome of the bats, allowing the algorithm to exclude non-host sequences. Only genes with a statistically significant change (padj ≤ 0.05) and at least a 2-fold change in expression (log2FoldChange ≥ 1.0 or ≤ -1.0) are considered as differentially expressed and reported here. The highest value is between frugivorous and insectivorous (n=14140), closely followed by nectarivorous with insectivorous (n=13315) and the value dropped notably to n=2632: between frugivorous and nectarivorous bats, suggesting a similar expression exhibited by these plant-based diet group (Table 6.3).

Table 6.3: The statistical data of differential genes.

Comparison	All	Up	Down
Frugivorous vs Insectivorous	14140	4153	9987
Nectarivorous vs Insectivorous	13315	12645	670
Frugivorous vs Nectarivorous	2632	1425	1207

Enrichment Analysis of the expressed genes between plant-based and insect-based diet.

To produce a more consolidated enrichment analysis of the GO Differently Expressed Genes (DEGs) and KEGG Enrichment Plot, the data were reorganized into two main dietary groups—plant-based (encompassing fruit and nectar diets) and insect-based. This categorization was undertaken to streamline the analysis and facilitate a clearer comparison between the plant-based and insect-based dietary preferences. This allows a

more focused exploration of the associated gene expression patterns and enable determination of expressions with significant different compared to each other.

GO enrichment analysis of DEGs revealed that transferase activity, transferring glycosyl groups was the only significantly differentially expressed gene between plant-based and insect-based diets (Figure 6.6). No other gene ontology (GO) terms showed significant differences in expression between the two dietary groups.

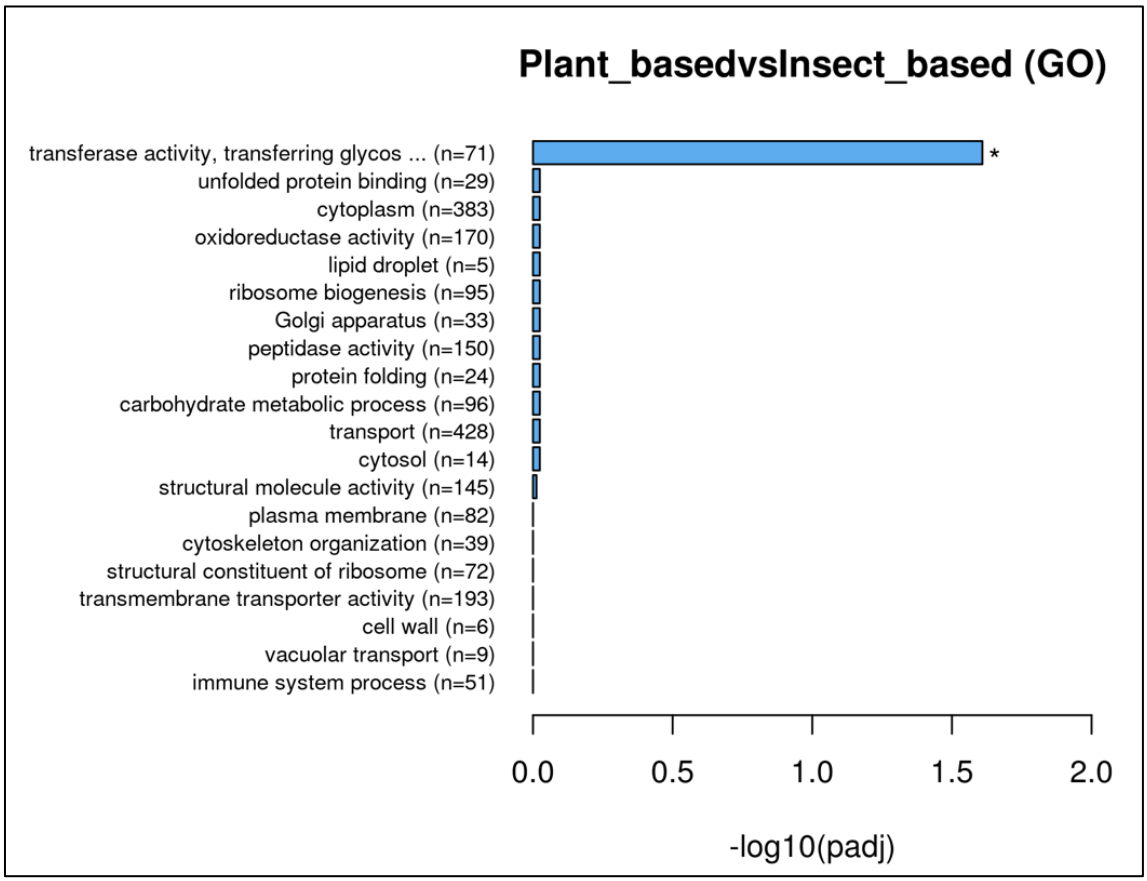


Figure 6.6: The bar chart showing the value of -log10(padj) for all Gene Ontology (GO) term expressed by the bats with plant based versus insect-based diet. The asterisk indicates significant different ($P<0.05$).

The gene expression data was linked to the KEGG pathway to analyse the significant enrichment between the two dietary preferences. It was found that metabolic pathways showed the most significant difference (-log10(padj) = 12), followed by retinol metabolism (-log10(padj) = 7.9), metabolism of xenobiotics by cytochrome P450 (-log10(padj) = 6.8), vitamin digestion and absorption (-log10(padj) = 6.6) and antigen processing and presentation (-log10(padj) = 6.3) (Figure 6.7).

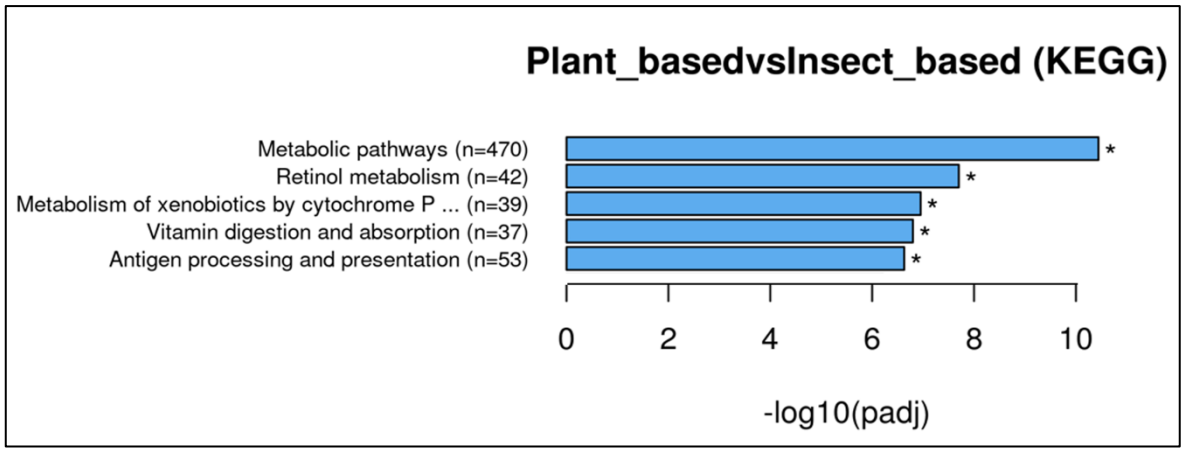


Figure 6.7: The bar chart showing the value of -log10(padj) for all KEGG pathway enriched by the bats with plant based versus insect-based diet. The asterisk indicates significant different (P<0.05).

6.3 Discussion

Differently expressed gene and pathway enrichments between bats of varied diet

This study systematically tested and revealed the gene expression profiles and enrichment pathways of bats from different diet preferences. Based on the GO Enrichment

of DEGs, the transferase activity: transferring glycosyl group was detected to be highly expressed in bats of plant-based diet, significantly higher than the bats of insect-based preference. This is further supported through the detection of enriched metabolic pathways in the bats of plant-based diet through KEGG pathways. Both are related with enzymes involved in breaking down complex carbohydrates. This is because plants contain complex carbohydrates (polysaccharides) such as cellulose, hemicellulose, starch, and various types of glycoproteins and glycolipids (Cseke & Kaufman, 1999; Terra & Ferreira, 2012; Karasov & Douglas, 2013). This require enzymatic modification turning the complex carbohydrates into simpler forms that can be absorbed and utilized by the host (Cantarel et al., 2012; Dashty, 2013; Kaoutari et al., 2013; Chandel, 2021). In contrast, bats consuming insects would have different metabolic requirements, as insects contain simpler nutrients such as proteins and lipids (Józefiak et al., 2016; Oonincx & Finke, 2021).

Apart from metabolic pathways, the KEGG enrichment pathways also detected other four highly enriched pathways from the sample set. The vitamin digestion and absorption pathways together with retinol metabolism pathways are highly detected in bats with plant-based diet. Vitamins are essential compounds required for several physiological functions in animals, including growth, metabolism, and immune system function (Aslam et al., 2017; Dawood & Koshio, 2018; Alagawany et al., 2021).

Some vitamins can be synthesised by animals, whereas others must be obtained from dietary sources such as vitamin A (retinol), vitamin C (ascorbic acid), and many vitamin B such as thiamine, riboflavin, and niacin (Rucker & Morris, 1997; Mielgo-Ayuso et al., 2018; Morris & Mohiuddin, 2020; Kokande et al., 2024). Retinol, often known as vitamin A, is mostly found in animal-derived foods such as liver, eggs, and dairy products (EFSA, 2015).

Plants have carotenoids that can be converted into retinol, a form of vitamin A in mammals (Eroglu & Harrison, 2013). Insect-based diet animals can obtain sufficient retinol from the insects they eat, as insects can retain retinol from their diet (Finke et al., 2020; Oonincx & Finke, 2021). Therefore, they require less enrichment of retinol metabolic pathways compared to animals that consume a plant-based diet.

The two highly enriched pathways detected in insect eating bats are metabolism of xenobiotics by cytochrome P450, and antigen processing and presentation. Xenobiotics are foreign chemicals such as medications, environmental toxins, pesticides, food preservatives, and other synthetic compounds that are not normally present or expected to be detected in the organism's body (Štefanac et al., 2021; Iovdijová & Bencko, 2010; Ben-Seghir et al., 2023). It can enter the body through several mechanisms such as ingestion, inhalation, or absorption through the skin (Frankikin, 2014; Kim, 2017). Cytochrome P450 enzymes are a diverse group of enzymes involved in metabolising many foreign compounds including xenobiotics (Anzenbacher & Anzenbacherova, 2001). Insects often encounter different xenobiotics in their environment, such as pesticides causing increased activity in pathways associated with xenobiotic metabolism by cytochrome P450 in insectivorous bats (Pittendrigh et al., 2014; Gao et al., 2022). This enrichment allows the bats to efficiently break down and eliminate the diverse range of foreign chemicals included in their insect diet.

The antigen processing and presentation are crucial components of the immune system that detect and respond to foreign substances such as diseases and toxins (Kotsias et al., 2019). Similar with xenobiotics, insectivorous bats require robust immune responses to defend against illnesses caused by diverse microorganisms and potential diseases in their environment (Štefanac et al., 2021; Iovdijová & Bencko, 2010; Ben-Seghir et al., 2023). Insects are well studied to be among the important vector for many pathogens (e.g. Federici,

2009; Nadarasah & Stavrinides, 2011; Leger, 2021; Eleftherianos et al., 2022). The highly expressed pathways associated with antigen processing and presentation allows insectivorous bats recognise and respond to antigens from ingested insects, assisting in immunological surveillance and defence. Bats with plant-based diet may encounter xenobiotics and pathogens in their environment, but the sources are lesser that they may not rely as much on cytochrome P450 and antigen processing and presentation pathways for detoxification.

6.4 Conclusion

This study had successfully report and discussed the gene expressions alongside the metabolic pathways in relation to the bat's dietary preferences. The bats that favor plant-based diet are detected to express a very prominent genetic expression related to metabolic pathways of carbohydrate digestion and vitamin absorption. While the insectivorous bats priorities the pathway for xenobiotic metabolism and immune defense against pathogenic treats carried by their prey. This study provides important fundamental knowledge for future research on the gene expressions of bats in Borneo. Studying the genetic mechanisms related to carbohydrate digestion, vitamin absorption, xenobiotic metabolism, and immunological defense helps us understand how bats adjust to their diets and environments. This insight improves the understanding of bat biology and shows the complex relationship between genes and environmental factors. This study establishes a foundation for future research on the gene expressions behind dietary adaptations in bats, that will support the conservation strategies aiming to protect the diverse dietary niches of bat species in Borneo.

CHAPTER 7

GENERAL DISCUSSION, FUTURE DIRECTION AND CONCLUSION

7.1 General discussion

This study is looking at the link between bat diet preferences with host microbiome compositions, taking account on the presence of pathogenic bacteria and its AMR properties. The de novo transcriptome and functional annotation for six species of bats were also done to investigate on how the genes are expressed to cope with bat's diet preferences.

The study on bat's host microbiome showed that despite having a smaller sample size, the phytophagous bats (Simpson, 1-*D* = 0.924) were detected to have a slightly higher microbiome diversity as compared to the insectivorous diet (Simpson, 1-*D* = 0.915). This can be directly related to the needs of herbivory diet to have a broader array of microbial enzymes that assist in the digestion of complex plant materials (Karasov et al., 2011). The correlation between the bat's diet and bacteria composition can be observed in both types of diet where Streptoccoccaceae is highly detected in phytophagous bats, indicating a role in fruit fermentation (Orbach et al., 2010) and insectivorous bats showed higher level of Enterobacteriaceae, potentially acquired from the ingested insects (Schmid et al., 2014; Higuita-Palacio et al., 2021). Correlation network analysis also had successfully showed negative correlation between the probiotic bacteria, *Lactobacillus* with pathogenic bacteria detected in bats highlighting the intricate relationship between bat diet preferences and gut microbiome composition. While most of the bacteria detected are beneficial or harmless, some of the detected bacteria pose significant health risk to human such as *Citrobacter*

koseri (e.g. infant meningitis), *Enterococcus faecalis* (e.g. endocarditis), *Escherichia coli* (e.g. bloody diarrhoea), and *Shigella sonnei* (e.g. bloody diarrhoea).

Bats are capable of tolerating and regulating bacterial infections without exhibiting clinical signs, thanks to its unique immune system and social behaviour (Brook & Dobson, 2015; Rosli et al., 2018; Banerjee et al., 2020; Egret-Berg et al., 2021). When the pathogenic bacteria are harboured by the bat's microbiome, the chances of zoonotic spill over increases as the bats are living in a proximity from humans (Wood et al., 2012; Veikkolainen et al., 2014). The detection of antimicrobial resistance in the Bornean bats are concerning as this could posed an increased danger of 'superbug' spill over. The environmental pollution with antibiotics and the interaction human-bats are hypothesised as the contributing factor for the emergence and spread of the bacteria with antibiotic resistance characteristics (Pruden et al., 2006; Allen et al., 2010; Warnecke et al., 2012; Vandeweyer et al., 2019; Monahan et al., 2021; Jia et al., 2022). The immediate suggestion would be to spread awareness for the public on how risky it is to consume the bats as delicacies, as this have been found to be still practiced in some part of Borneo. Another proactive action includes bats population monitoring, reducing the environmental antibiotic pollution, and advocating for the ethical antibiotic usage in human and veterinary medicine (Mackenzie et al., 2013; Cunningham et al., 2017). These actions are important to avoid the spillover incidents that eventually will reduce the consequences of antibiotic resistant bacteria on human health and healthcare system (Ellwanger & Chies, 2021a; Ellwanger et al., 2021b; Ogunseitan, 2022).

The study on bat's diet is further explored through the transcriptome analysis that successfully unveils fascinating insight into the molecular mechanism that responsible for the bat's remarkable adaptations and physiological capabilities. Some of the highly functional groups detected in bats are cellular process muscle development (e.g.

GO:0044260), auditory system function and development (e.g. GO:0007165), haemoglobin and oxygen transport (e.g. GO:0046906), immune system (e.g. GO:0005102), energy metabolism (e.g. GO:0006754), and torpor (e.g. GO:0015980). All of these functional groups are essential for the bats to carry on its daily necessities such as flying, echolocation, hibernation, resilient immune systems and varied diet preferences (Buckles, 2015; Serra-Cobo & Lopez-Roig, 2017; Santillan et al., 2021; Power et al., 2022).

The dietary preferences further shaped the highly expressed genes and enrichment pathways in bats, highlighting the significant metabolic diversification. The plant-based eating bats exhibit enriched pathways related to carbohydrate metabolism and vitamin digestion that are responsible in processing the complex carbohydrates and obtaining essential nutrients from plant sources (Cseke and Kaufman, 1999; Cantarel et al., 2012; Terra & Ferreira, 2012; Karasov & Douglas, 2013; Dashty, 2013; Kaoutari et al., 2013; Chandel, 2021). In contrast, the insect eating bats showed enrichment in pathways that is related to xenobiotic metabolism and antigen processing that are related in their immune system and detoxification mechanism. These are highly necessary as the insectivorous bats need to handle diverse pathogens and foreign compounds encountered in insect prey (Štefanac et al., 2021; Iovdijová & Bencko, 2010; Ben-Seghir et al., 2023).

While this study provides valuable insights into the relationship between bat diet preferences, gut microbiome composition, and gene expression, several limitations should be considered when interpreting the findings. One of the primary limitations is the sample size variation across chapters. The first two chapters analyzed a total of 30 bat individuals, providing a broader representation of microbiome diversity. However, the third chapter, focusing on transcriptomic analysis, was limited to six samples due to logistical challenges and financial constraints. While this sample allows for preliminary comparisons, a larger

dataset would enhance statistical power and provide a more comprehensive understanding of gene expression variations across dietary groups.

Another key limitation is the quality of DNA and RNA extracted from fecal samples, which may introduce biases due to DNA degradation and potential contamination from environmental sources. Similarly, RNA extraction for transcriptomic analysis was subject to quality variations, which could influence gene expression results. Future studies using fresh tissue samples under controlled conditions could improve the accuracy and reliability of the data.

Additionally, the geographical and species representation, while spanning different locations across Borneo, may not fully capture the diversity of dietary adaptations within bat populations. Expanding the geographic range and including a broader range of bat species would enhance the generalizability of the findings. Furthermore, this study presents a single time-point snapshot of microbiome composition, which may not fully reflect seasonal or dietary variations. Longitudinal studies tracking microbiome changes over time would offer deeper insights into how diet and environmental factors shape microbial communities.

Finally, environmental factors such as habitat disturbance, pollution, and antibiotic exposure were not directly quantified in this study, though they may influence both microbial composition and gene expression in bats. Incorporating environmental monitoring in future studies would help disentangle these potential confounding variables. By acknowledging these limitations, this study highlights the need for further research with larger datasets, improved sample collection methods, and integrative approaches to better understand the intricate relationship between bat diet, gut microbiome, and gene expression.

7.2 Future directions

1. *Future viral studies are recommended.* - This study successfully determined and focused on the bacterial components within the bat community in Malaysian Borneo. Yet, it is very important for future studies to investigate the viral component that is present in the bats within this region. Performing studies on viruses could help in improving the understanding of the health and disease trends in the bat population. By having both studies on bacterial and viral pathogens, efficient approaches can be developed for monitoring and controlling zoonotic diseases. The scope of the studies can be broadened to include virus detection, modes of transmission, and the potential effects that they may have on the health of both humans and animals. By adopting these two prolonged strategies, the capacity to predict and mitigate risks that are linked to emerging infectious diseases can be improved.
2. *Increase sample set* – Although this study utilised a substantial number of bat individuals, species, and dietary groups, which later resulted in valuable findings, expanding the sample set alongside a broader geographic distribution is expected to successfully yield more comprehensive results. The robustness of the data can be obtained by having a large and more diverse sample set. This will allow for accurate and generalised conclusions. To achieve this, the samples are recommended to be obtained from a wider range of localities, capturing different habitats and environmental conditions. These will eventually improve our understanding of the biodiversity and ecological interactions within bat populations, resulting in more effective bat conservation strategies and ensuring the well-being of both wildlife and human populations.

3. *Suggestion for future transcriptomic studies* – This study included the transcriptomic analysis of six bat individuals, which was mainly limited due to budget constraints. It is recommended to increase the number of individuals sampled in future studies to enhance the data robustness and validation, as more gene expression patterns, and variation can be observed across different individuals and dietary preferences. Incorporating individuals from different geographical areas with additional bat species will help in understanding if there is a presence of interspecies differences and ecological interactions that may influence gene expression related to dietary preferences. The other recommendation is to include longitudinal studies tracking the changes in the bat's gene expression over time to explore the bat's dynamic response to seasonal and environmental changes.

7.3 Conclusions

This research provides a comprehensive understanding of the intricate relationship between bat diet preferences, gut microbiome composition, and transcriptomic adaptations, with a specific focus on the presence of pathogenic bacteria and antimicrobial resistance (AMR) properties. By examining these interrelated factors, this study shed the light on critical aspects of bat dietary ecology, host physiology, and potential public health implications. The findings on the correlation between bat diet and microbiome composition highlight the significant influence of dietary preferences in shaping the gut microbial community. Furthermore, the detection of pathogenic and antimicrobial-resistant bacteria underscores the potential health risks posed by bat-borne diseases, emphasizing the need for continued surveillance and mitigation strategies. Additionally, the transcriptomic analysis offers invaluable insights into the molecular mechanisms underlying dietary adaptations in

bats, revealing metabolic processes crucial for digestion, immune function, and ecological resilience.

In addressing the research questions posed in this study, several key findings emerge. The first research question regarding the gut microbes essential for bat well-being was thoroughly explored by identifying microbial taxa associated with digestion and nutrient absorption. These microbes play a crucial role in breaking down dietary components, particularly in phytophagous bats, which rely on specialized bacteria for processing complex carbohydrates. The second research question, which examines zoonotic potential and AMR properties in bat microbiomes, was addressed through bacterial screening that revealed the presence of known pathogenic species such as *Citrobacter koseri*, *Enterococcus faecalis*, *Escherichia coli* and *Shigella sonnei*. The detection of AMR-related genes further highlights the potential risks associated with environmental antibiotic pollution and bat-human interactions. Lastly, the third research question on whether dietary preferences influence gut microbiome gene expression was answered through transcriptomic analyses that revealed distinct gene expression patterns linked to metabolic pathways essential for digesting plant-based or insect-based diets.

In testing the study's hypotheses, the findings provide strong support for dietary influence on microbiome composition, pathogen presence, and gene expression. The first hypothesis, which hypothesised that different bat species with varying diets exhibit distinct microbiome compositions, is supported by the observed bacterial diversity differences between phytophagous and insectivorous bats. The second hypothesis, suggesting that dietary diversity influences pathogen profiles and AMR properties, is also validated, as bats consuming a broader range of food sources harbor more varied bacterial communities, including both beneficial and potentially harmful microbes. The third hypothesis, predicting

that gene expression profiles will vary based on dietary needs, is confirmed through transcriptomic data showing enrichment of metabolic pathways linked to digestion and immune function.

The study objectives were successfully met, offering valuable insights into bat ecology and its implications for conservation and public health. The comparative analysis of bacterial communities among different dietary groups provided a deeper understanding of microbiome composition and its functional roles. The detection of pathogenic bacteria and antimicrobial resistance genes highlighted the need for continued monitoring, particularly in regions where human-bat interactions are common. Lastly, the transcriptomic findings provided a molecular perspective on how bats adapt to their respective diets, reinforcing the ecological and evolutionary significance of dietary specialization.

By revisiting the research questions, validating hypotheses, and addressing study objectives, this research not only enhances understanding of bat biology in Borneo but also provides a foundation for future studies on host-microbiome interactions, zoonotic disease risks, and conservation strategies. Moving forward, expanding sample sizes, integrating metagenomic approaches, and examining seasonal variations in diet and microbiome composition will further refine the understanding of these complex ecological relationships.

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APPENDICES

Appendix 1

List of bacteria detected from sample set

Phylum	Family	*Genus*	*Species*
Acidobacteriota	Acidobacteriaceae	*Edaphobacter*	*Edaphobacter aggregans*
Acidobacteriota	Acidobacteriaceae	*Edaphobacter*	*Edaphobacter dinghuensis*
Acidobacteriota	Acidobacteriaceae	*Edaphobacter*	*Edaphobacter modestus*
Acidobacteriota	Acidobacteriaceae	*Granulicella*	*Granulicella arctica*
Acidobacteriota	Acidobacteriaceae	*Granulicella*	*Granulicella cerasi*
Acidobacteriota	Acidobacteriaceae	*Granulicella*	*Granulicella mallensis*
Acidobacteriota	Acidobacteriaceae	*Granulicella*	*Granulicella paludicola*
Acidobacteriota	Blastocatellaceae	*Tellurimicrobium*	*Tellurimicrobium multivorans*
Acidobacteriota	Acidobacteriaceae	*Terriglobus*	*Terriglobus aquaticus*
Acidobacteriota	Acidobacteriaceae	*Terriglobus*	*Terriglobus roseus*
Acidobacteriota	Vicinamibacteraceae	*Vicinamibacter*	*Vicinamibacter silvestris*
Actinomycetota	Acidimicrobiaceae	*Aciditerrimonas*	*Aciditerrimonas ferrireducens*
Actinomycetota	Pseudonocardiaceae	*Actinoalloteichus*	*Actinoalloteichus cyanogriseus*
Actinomycetota	Pseudonocardiaceae	*Actinoalloteichus*	*Actinoalloteichus hoggarensis*
Actinomycetota	Actinomycetaceae	*Actinomyces*	*Actinomyces graevenitzii*

Actinomycetota	Actinomycetaceae	*Actinomyces*	*Actinomyces marimammalium*
Actinomycetota	Actinomycetaceae	*Actinomyces*	*Actinomyces polynesiensis*
Actinomycetota	Actinomycetaceae	*Actinomyces*	*Actinomyces urogenitalis*
Actinomycetota	Pseudonocardiaceae	*Actinomycetospora*	*Actinomycetospora succinea*
Actinomycetota	Pseudonocardiaceae	*Actinophytocola*	*Actinophytocola xinjiangensis*
Actinomycetota	Eggerthellaceae	*Adlercreutzia*	*Adlercreutzia caecimuris*
Actinomycetota	Nocardioidaceae	*Aeromicrobium*	*Aeromicrobium erythreum*
Actinomycetota	Microbacteriaceae	*Agrococcus*	*Agrococcus terreus*
Actinomycetota	Microbacteriaceae	*Agromyces*	*Agromyces ramosus*
Actinomycetota	Microbacteriaceae	*Agromyces*	*Agromyces terreus*
Actinomycetota	Pseudonocardiaceae	*Allosaccharopolyspora*	*Allosaccharopolyspora coralli*
Actinomycetota	Microbacteriaceae	*Amnibacterium*	*Amnibacterium kyonggiense*
Actinomycetota	Pseudonocardiaceae	*Amycolatopsis*	*Amycolatopsis decaplanina*
Actinomycetota	Pseudonocardiaceae	*Amycolatopsis*	*Amycolatopsis magusensis*
Actinomycetota	Pseudonocardiaceae	*Amycolatopsis*	*Amycolatopsis methanolica*
Actinomycetota	Pseudonocardiaceae	*Amycolatopsis*	*Amycolatopsis sacchari*
Actinomycetota	Angustibacteraceae	*Angustibacter*	*Angustibacter speluncae*
Actinomycetota	Micrococcaceae	*Arthrobacter*	*Arthrobacter ginkgonis*
Actinomycetota	Micrococcaceae	*Arthrobacter*	*Arthrobacter pascens*
Actinomycetota	Micrococcaceae	*Arthrobacter*	*Arthrobacter pokkalii*
Actinomycetota	Micrococcaceae	*Arthrobacter*	*Arthrobacter psychrochitiniphilus*
Actinomycetota	Dermabacteraceae	*Brachybacterium*	*Brachybacterium conglomeratum*

Actinomycetota	Dermabacteraceae	*Brachybacterium*	*Brachybacterium hainanense*
Actinomycetota	Dermabacteraceae	*Brachybacterium*	*Brachybacterium huguangmaarense*
Actinomycetota	Dermabacteraceae	*Brachybacterium*	*Brachybacterium nesterenkovii*
Actinomycetota	Dermabacteraceae	*Brachybacterium*	*Brachybacterium paraconglomeratum*
Actinomycetota	Dermabacteraceae	*Brachybacterium*	*Brachybacterium phenoliresistens*
Actinomycetota	Dermabacteraceae	*Brachybacterium*	*Brachybacterium squillarum*
Actinomycetota	Brevibacteriaceae	*Brevibacterium*	*Brevibacterium frigoritolerans*
Actinomycetota	Brevibacteriaceae	*Brevibacterium*	*Brevibacterium oceani*
Actinomycetota	Brevibacteriaceae	*Brevibacterium*	*Brevibacterium sanguinis*
Actinomycetota	Brevibacteriaceae	*Brevibacterium*	*Brevibacterium sediminis*
Actinomycetota	Catenulisporaceae	*Catenulispora*	*Catenulispora fulva*
Actinomycetota	Cellulomonadaceae	*Cellulosimicrobium*	*Cellulosimicrobium cellulans*
Actinomycetota	Solirubrobacteraceae	*Conexibacter*	*Conexibacter arvalis*
Actinomycetota	Solirubrobacteraceae	*Conexibacter*	*Conexibacter stalactiti*
Actinomycetota	Solirubrobacteraceae	*Conexibacter*	*Conexibacter woesei*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium accolens*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium appendicis*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium atypicum*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium aurimucosum*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium bovis*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium caspium*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium confusum*

Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium cystitidis*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium efficiens*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium falsenii*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium flavescens*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium glyciniphilum*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium godavarianum*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium halotolerans*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium jeikeium*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium lipophiloflavum*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium macginleyi*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium massiliense*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium mastitidis*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium pilosum*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium tapiri*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium terpenotabidum*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium tuberculostearicum*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium urealyticum*
Actinomycetota	Mycobacteriaceae	*Corynebacterium*	*Corynebacterium variabile*
Actinomycetota	Microbacteriaceae	*Cryobacterium*	*Cryobacterium tepidiphilum*
Actinomycetota	Cryptosporangiaceae	*Cryptosporangium*	*Cryptosporangium eucalypti*
Actinomycetota	Microbacteriaceae	*Curtobacterium*	*Curtobacterium albidum*
Actinomycetota	Microbacteriaceae	*Curtobacterium*	*Curtobacterium citreum*

Actinomycetota	Microbacteriaceae	*Curtobacterium*	*Curtobacterium luteum*
Actinomycetota	Microbacteriaceae	*Curtobacterium*	*Curtobacterium oceanosedimentum*
Actinomycetota	Microbacteriaceae	*Curtobacterium*	*Curtobacterium plantarum*
Actinomycetota	Microbacteriaceae	*Curtobacterium*	*Curtobacterium pusillum*
Actinomycetota	Propionibacteriaceae	*Cutibacterium*	*Cutibacterium granulosum*
Actinomycetota	Dermatophilaceae	*Dermacoccus*	*Dermacoccus abyssi*
Actinomycetota	Mycobacteriaceae	*Dietzia*	*Dietzia timorensis*
Actinomycetota	Eggerthellaceae	*Eggerthella*	*Eggerthella timonensis*
Actinomycetota	Dermatophilaceae	*Flexivirga*	*Flexivirga alba*
Actinomycetota	Dermatophilaceae	*Flexivirga*	*Flexivirga endophytica*
Actinomycetota	Actinomycetaceae	*Fudania*	*Fudania jinshanensis*
Actinomycetota	Micrococcaceae	*Galactobacter*	*Galactobacter valiniphilus*
Actinomycetota	Mycobacteriaceae	*Gordonia*	*Gordonia alkaliphila*
Actinomycetota	Mycobacteriaceae	*Gordonia*	*Gordonia araii*
Actinomycetota	Mycobacteriaceae	*Gordonia*	*Gordonia bronchialis*
Actinomycetota	Mycobacteriaceae	*Gordonia*	*Gordonia effusa*
Actinomycetota	Mycobacteriaceae	*Gordonia*	*Gordonia hongkongensis*
Actinomycetota	Mycobacteriaceae	*Gordonia*	*Gordonia humi*
Actinomycetota	Mycobacteriaceae	*Gordonia*	*Gordonia iterans*
Actinomycetota	Mycobacteriaceae	*Gordonia*	*Gordonia kroppenstedtii*
Actinomycetota	Mycobacteriaceae	*Gordonia*	*Gordonia namibiensis*
Actinomycetota	Mycobacteriaceae	*Gordonia*	*Gordonia phthalatica*

Actinomycetota	Mycobacteriaceae	*Gordonia*	*Gordonia polyisoprenivorans*
Actinomycetota	Mycobacteriaceae	*Gordonia*	*Gordonia rubripertincta*
Actinomycetota	Mycobacteriaceae	*Gordonia*	*Gordonia shandongensis*
Actinomycetota	Mycobacteriaceae	*Gordonia*	*Gordonia soli*
Actinomycetota	Microbacteriaceae	*Gulosibacter*	*Gulosibacter bifidus*
Actinomycetota	Microbacteriaceae	*Gulosibacter*	*Gulosibacter chungangensis*
Actinomycetota	Microbacteriaceae	*Herbiconiux*	*Herbiconiux ginsengi*
Actinomycetota	Microbacteriaceae	*Humibacter*	*Humibacter albus*
Actinomycetota	Microbacteriaceae	*Humibacter*	*Humibacter soli*
Actinomycetota	Ilumatobacteraceae	*Ilumatobacter*	*Ilumatobacter fluminis*
Actinomycetota	Ilumatobacteraceae	*Ilumatobacter*	*Ilumatobacter nonamiensis*
Actinomycetota	Dermatophilaceae	*Intrasporangium*	*Intrasporangium chromatireducens*
Actinomycetota	Cellulomonadaceae	*Isoptericola*	*Isoptericola cucumis*
Actinomycetota	Dermatophilaceae	*Janibacter*	*Janibacter indicus*
Actinomycetota	Jatrophihabitantaceae	*Jatrophihabitans*	*Jatrophihabitans endophyticus*
Actinomycetota	Jatrophihabitantaceae	*Jatrophihabitans*	*Jatrophihabitans soli*
Actinomycetota	Streptomycetaceae	*Kitasatospora*	*Kitasatospora atroaurantiaca*
Actinomycetota	Streptomycetaceae	*Kitasatospora*	*Kitasatospora cystarginea*
Actinomycetota	Streptomycetaceae	*Kitasatospora*	*Kitasatospora griseola*
Actinomycetota	Streptomycetaceae	*Kitasatospora*	*Kitasatospora setae*
Actinomycetota	Streptomycetaceae	*Kitasatospora*	*Kitasatospora terrestris*
Actinomycetota	Dermatophilaceae	*Knoellia*	*Knoellia remsis*

Actinomycetota	Micrococcaceae	*Kocuria*	*Kocuria dechangensis*
Actinomycetota	Micrococcaceae	*Kocuria*	*Kocuria indica*
Actinomycetota	Micrococcaceae	*Kocuria*	*Kocuria koreensis*
Actinomycetota	Micrococcaceae	*Kocuria*	*Kocuria rosea*
Actinomycetota	Dermatophilaceae	*Kytococcus*	*Kytococcus sedentarius*
Actinomycetota	Microbacteriaceae	*Leifsonia*	*Leifsonia lichenia*
Actinomycetota	Microbacteriaceae	*Leifsonia*	*Leifsonia naganoensis*
Actinomycetota	Microbacteriaceae	*Leifsonia*	*Leifsonia poae*
Actinomycetota	Microbacteriaceae	*Leifsonia*	*Leifsonia shinshuensis*
Actinomycetota	Microbacteriaceae	*Leifsonia*	*Leifsonia xyli*
Actinomycetota	Microbacteriaceae	*Leucobacter*	*Leucobacter aridicollis*
Actinomycetota	Microbacteriaceae	*Leucobacter*	*Leucobacter chromiiresistens*
Actinomycetota	Microbacteriaceae	*Leucobacter*	*Leucobacter populi*
Actinomycetota	Microbacteriaceae	*Leucobacter*	*Leucobacter tardus*
Actinomycetota	Cellulomonadaceae	*Luteimicrobium*	*Luteimicrobium album*
Actinomycetota	Nocardioidaceae	*Marmoricola*	*Marmoricola pocheonensis*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium arabinogalactanolyticum*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium aureliae*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium barkeri*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium deminutum*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium deserti*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium esteraromaticum*

Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium foliorum*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium ginsengisoli*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium hatanonis*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium hominis*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium invictum*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium jejuense*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium kyungheense*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium lacus*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium marinum*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium neimengense*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium paraoxydans*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium phyllosphaerae*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium pseudoresistens*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium saccharophilum*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium schleiferi*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium suaedae*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium terregens*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium trichothecenolyticum*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium ulmi*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium xylanilyticum*
Actinomycetota	Microbacteriaceae	*Microbacterium*	*Microbacterium yannicii*
Actinomycetota	Micrococcaceae	*Micrococcus*	*Micrococcus luteus*

Actinomycetota	Propionibacteriaceae	*Microlunatus*	*Microlunatus aurantiacus*
Actinomycetota	Propionibacteriaceae	*Microlunatus*	*Microlunatus ginsengisoli*
Actinomycetota	Propionibacteriaceae	*Microlunatus*	*Microlunatus phosphovorus*
Actinomycetota	Micromonosporaceae	*Micromonospora*	*Micromonospora pattaloongensis*
Actinomycetota	Propionibacteriaceae	*Micropruina*	*Micropruina glycogenica*
Actinomycetota	Mycobacteriaceae	*Mycobacterium*	*Mycobacterium asiaticum*
Actinomycetota	Mycobacteriaceae	*Mycobacterium*	*Mycobacterium chelonae*
Actinomycetota	Mycobacteriaceae	*Mycobacterium*	*Mycobacterium cookii*
Actinomycetota	Mycobacteriaceae	*Mycobacterium*	*Mycobacterium haemophilum*
Actinomycetota	Mycobacteriaceae	*Mycobacterium*	*Mycobacterium palauense*
Actinomycetota	Mycobacteriaceae	*Mycobacterium*	*Mycobacterium porcinum*
Actinomycetota	Mycobacteriaceae	*Mycobacteroides*	*Mycobacteroides abscessus*
Actinomycetota	Mycobacteriaceae	*Mycobacteroides*	*Mycobacteroides immunogenum*
Actinomycetota	Mycobacteriaceae	*Mycolicibacterium*	*Mycolicibacterium fortuitum*
Actinomycetota	Mycobacteriaceae	*Mycolicibacterium*	*Mycolicibacterium gilvum*
Actinomycetota	Mycobacteriaceae	*Mycolicibacterium*	*Mycolicibacterium insubricum*
Actinomycetota	Mycobacteriaceae	*Mycolicibacterium*	*Mycolicibacterium madagascariense*
Actinomycetota	Mycobacteriaceae	*Mycolicibacterium*	*Mycolicibacterium mageritense*
Actinomycetota	Mycobacteriaceae	*Mycolicibacterium*	*Mycolicibacterium mucogenicum;Mycolicibacterium*
Actinomycetota	Mycobacteriaceae	*Mycolicibacterium*	*Mycolicibacterium murale*
Actinomycetota	Mycobacteriaceae	*Mycolicibacterium*	*Mycolicibacterium neoaurum*

Actinomycetota	Mycobacteriaceae	*Mycolicibacterium*	*Mycolicibacterium parafortuitum*
Actinomycetota	Mycobacteriaceae	*Mycolicibacterium*	*Mycolicibacterium psychrotolerans*
Actinomycetota	Mycobacteriaceae	*Mycolicibacterium*	*Mycolicibacterium smegmatis*
Actinomycetota	Mycobacteriaceae	*Mycolicibacterium*	*Mycolicibacterium sphagni*
Actinomycetota	Mycobacteriaceae	*Mycolicibacterium*	*Mycolicibacterium wolinskyi*
Actinomycetota	Nakamurellaceae	*Nakamurella*	*Nakamurella flavida*
Actinomycetota	Nakamurellaceae	*Nakamurella*	*Nakamurella lactea*
Actinomycetota	Nakamurellaceae	*Nakamurella*	*Nakamurella multipartita*
Actinomycetota	Propionibacteriaceae	*Naumannella*	*Naumannella huperziae*
Actinomycetota	Micrococcaceae	*Nesterenkonia*	*Nesterenkonia alba*
Actinomycetota	Micrococcaceae	*Nesterenkonia*	*Nesterenkonia cremea*
Actinomycetota	Micrococcaceae	*Nesterenkonia*	*Nesterenkonia lacusekhoensis*
Actinomycetota	Micrococcaceae	*Nesterenkonia*	*Nesterenkonia suensis*
Actinomycetota	Mycobacteriaceae	*Nocardia*	*Nocardia aobensis*
Actinomycetota	Mycobacteriaceae	*Nocardia*	*Nocardia artemisiae*
Actinomycetota	Mycobacteriaceae	*Nocardia*	*Nocardia carnea*
Actinomycetota	Mycobacteriaceae	*Nocardia*	*Nocardia exalbida*
Actinomycetota	Mycobacteriaceae	*Nocardia*	*Nocardia gamkensis*
Actinomycetota	Mycobacteriaceae	*Nocardia*	*Nocardia higoensis*
Actinomycetota	Mycobacteriaceae	*Nocardia*	*Nocardia kroppenstedtii*
Actinomycetota	Mycobacteriaceae	*Nocardia*	*Nocardia lijiangensis*
Actinomycetota	Mycobacteriaceae	*Nocardia*	*Nocardia paucivorans*

Actinomycetota	Mycobacteriaceae	*Nocardia*	*Nocardia pneumoniae*
Actinomycetota	Mycobacteriaceae	*Nocardia*	*Nocardia rayongensis*
Actinomycetota	Mycobacteriaceae	*Nocardia*	*Nocardia terpenica*
Actinomycetota	Mycobacteriaceae	*Nocardia*	*Nocardia vaccinii*
Actinomycetota	Mycobacteriaceae	*Nocardia*	*Nocardia wallacei*
Actinomycetota	Nocardioidaceae	*Nocardioides*	*Nocardioides bigeumensis*
Actinomycetota	Nocardioidaceae	*Nocardioides*	*Nocardioides cavernae*
Actinomycetota	Nocardioidaceae	*Nocardioides*	*Nocardioides daecheongensis*
Actinomycetota	Nocardioidaceae	*Nocardioides*	*Nocardioides daedukensis*
Actinomycetota	Nocardioidaceae	*Nocardioides*	*Nocardioides dubius*
Actinomycetota	Nocardioidaceae	*Nocardioides*	*Nocardioides humi*
Actinomycetota	Nocardioidaceae	*Nocardioides*	*Nocardioides immobilis*
Actinomycetota	Nocardioidaceae	*Nocardioides*	*Nocardioides islandensis*
Actinomycetota	Nocardioidaceae	*Nocardioides*	*Nocardioides kribbensis*
Actinomycetota	Nocardioidaceae	*Nocardioides*	*Nocardioides lianchengensis*
Actinomycetota	Nocardioidaceae	*Nocardioides*	*Nocardioides marinquilinus*
Actinomycetota	Nocardioidaceae	*Nocardioides*	*Nocardioides panacihumi*
Actinomycetota	Nocardioidaceae	*Nocardioides*	*Nocardioides panacisoli*
Actinomycetota	Nocardioidaceae	*Nocardioides*	*Nocardioides soli*
Actinomycetota	Nocardioidaceae	*Nocardioides*	*Nocardioides taihuensis*
Actinomycetota	Nocardioidaceae	*Nocardioides*	*Nocardioides tritolerans*
Actinomycetota	Streptosporangiaceae	*Nonomuraea*	*Nonomuraea roseola*

Actinomycetota	Atopobiaceae	*Olegusella*	*Olegusella massiliensis*
Actinomycetota	Atopobiaceae	*Olsenella*	*Olsenella profusa*
Actinomycetota	Micrococcaceae	*Paenarthrobacter*	*Paenarthrobacter nicotinovorans*
Actinomycetota	Parviterribacteraceae	*Parviterribacter*	*Parviterribacter kavangonensis*
Actinomycetota	Solirubrobacteraceae	*Patulibacter*	*Patulibacter americanus*
Actinomycetota	Solirubrobacteraceae	*Patulibacter*	*Patulibacter brassicae*
Actinomycetota	Solirubrobacteraceae	*Patulibacter*	*Patulibacter ginsengiterrae*
Actinomycetota	Solirubrobacteraceae	*Patulibacter*	*Patulibacter minatonensis*
Actinomycetota	Micromonosporaceae	*Pilimelia*	*Pilimelia columellifera*
Actinomycetota	Cellulomonadaceae	*Promicromonospora*	*Promicromonospora alba*
Actinomycetota	Cellulomonadaceae	*Promicromonospora*	*Promicromonospora viridis*
Actinomycetota	Propionibacteriaceae	*Propionibacterium*	*Propionibacterium acidifaciens*
Actinomycetota	Propionibacteriaceae	*Propionibacterium*	*Propionibacterium cyclohexanicum*
Actinomycetota	Propionibacteriaceae	*Propionibacterium*	*Propionibacterium freudenreichii*
Actinomycetota	Microbacteriaceae	*Protaetiibacter*	*Protaetiibacter larvae*
Actinomycetota	Micrococcaceae	*Pseudarthrobacter*	*Pseudarthrobacter chlorophenolicus*
Actinomycetota	Micrococcaceae	*Pseudarthrobacter*	*Pseudarthrobacter defluvii*
Actinomycetota	Microbacteriaceae	*Pseudoclavibacter*	*Pseudoclavibacter chungangensis*
Actinomycetota	Microbacteriaceae	*Pseudoclavibacter*	*Pseudoclavibacter endophyticus*
Actinomycetota	Microbacteriaceae	*Pseudoclavibacter*	*Pseudoclavibacter helvolus*
Actinomycetota	Micrococcaceae	*Pseudoglutamicibacter*	*Pseudoglutamicibacter cumminsii*
Actinomycetota	Microbacteriaceae	*Pseudolysinimonas*	*Pseudolysinimonas kribbensis*

Actinomycetota	Pseudonocardiaceae	*Pseudonocardia*	*Pseudonocardia alaniniphila*
Actinomycetota	Pseudonocardiaceae	*Pseudonocardia*	*Pseudonocardia asaccharolytica*
Actinomycetota	Pseudonocardiaceae	*Pseudonocardia*	*Pseudonocardia carboxydivorans*
Actinomycetota	Pseudonocardiaceae	*Pseudonocardia*	*Pseudonocardia chloroethenivorans*
Actinomycetota	Pseudonocardiaceae	*Pseudonocardia*	*Pseudonocardia hydrocarbonoxydans*
Actinomycetota	Pseudonocardiaceae	*Pseudonocardia*	*Pseudonocardia nigra*
Actinomycetota	Pseudonocardiaceae	*Pseudonocardia*	*Pseudonocardia seranimata*
Actinomycetota	Pseudonocardiaceae	*Pseudonocardia*	*Pseudonocardia spinosa*
Actinomycetota	Pseudonocardiaceae	*Pseudonocardia*	*Pseudonocardia xinjiangensis*
Actinomycetota	Quadrisphaeraceae	*Quadrisphaera*	*Quadrisphaera granulorum*
Actinomycetota	Eggerthellaceae	*Raoultibacter*	*Raoultibacter massiliensis*
Actinomycetota	Eggerthellaceae	*Raoultibacter*	*Raoultibacter timonensis*
Actinomycetota	Microbacteriaceae	*Rathayibacter*	*Rathayibacter rathayi*
Actinomycetota	Microbacteriaceae	*Rathayibacter*	*Rathayibacter tritici*
Actinomycetota	Iamiaceae	*Rhabdothermincola*	*Rhabdothermincola sediminis*
Actinomycetota	Mycobacteriaceae	*Rhodococcus*	*Rhodococcus agglutinans*
Actinomycetota	Mycobacteriaceae	*Rhodococcus*	*Rhodococcus hoagii*
Actinomycetota	Mycobacteriaceae	*Rhodococcus*	*Rhodococcus rhodnii*
Actinomycetota	Mycobacteriaceae	*Rhodococcus*	*Rhodococcus rhodochrous*
Actinomycetota	Micrococcaceae	*Rothia*	*Rothia amarae*
Actinomycetota	Micrococcaceae	*Rothia*	*Rothia endophytica*
Actinomycetota	Micrococcaceae	*Rothia*	*Rothia koreensis*

Actinomycetota	Micrococcaceae	*Rothia*	*Rothia kristinae*
Actinomycetota	Rubrobacteraceae	*Rubrobacter*	*Rubrobacter radiotolerans*
Actinomycetota	Rubrobacteraceae	*Rubrobacter*	*Rubrobacter spartanus*
Actinomycetota	Rubrobacteraceae	*Rubrobacter*	*Rubrobacter taiwanensis*
Actinomycetota	Rubrobacteraceae	*Rubrobacter*	*Rubrobacter xylanophilus*
Actinomycetota	Pseudonocardiaceae	*Saccharomonospora*	*Saccharomonospora viridis*
Actinomycetota	Pseudonocardiaceae	*Saccharopolyspora*	*Saccharopolyspora cavernae*
Actinomycetota	Pseudonocardiaceae	*Saccharopolyspora*	*Saccharopolyspora cebuensis*
Actinomycetota	Pseudonocardiaceae	*Saccharopolyspora*	*Saccharopolyspora erythraea*
Actinomycetota	Pseudonocardiaceae	*Saccharopolyspora*	*Saccharopolyspora gloriosae*
Actinomycetota	Pseudonocardiaceae	*Saccharopolyspora*	*Saccharopolyspora gregorii*
Actinomycetota	Pseudonocardiaceae	*Saccharopolyspora*	*Saccharopolyspora halophila*
Actinomycetota	Pseudonocardiaceae	*Saccharopolyspora*	*Saccharopolyspora halotolerans*
Actinomycetota	Pseudonocardiaceae	*Saccharopolyspora*	*Saccharopolyspora hordei*
Actinomycetota	Pseudonocardiaceae	*Saccharopolyspora*	*Saccharopolyspora qijiaojingensis*
Actinomycetota	Pseudonocardiaceae	*Saccharopolyspora*	*Saccharopolyspora rectivirgula*
Actinomycetota	Pseudonocardiaceae	*Saccharopolyspora*	*Saccharopolyspora spongiae*
Actinomycetota	Pseudonocardiaceae	*Saccharothrix*	*Saccharothrix ecbatanensis*
Actinomycetota	Pseudonocardiaceae	*Salinifilum*	*Salinifilum aidingensis*
Actinomycetota	Actinomycetaceae	*Schaalia*	*Schaalia canis*
Actinomycetota	Actinomycetaceae	*Schaalia*	*Schaalia cardiffensis*
Actinomycetota	Actinomycetaceae	*Schaalia*	*Schaalia hyovaginalis*

Actinomycetota	Actinomycetaceae	*Schaalia*	*Schaalia meyeri*
Actinomycetota	Actinomycetaceae	*Schaalia*	*Schaalia naturae*
Actinomycetota	Actinomycetaceae	*Schaalia*	*Schaalia odontolytica*
Actinomycetota	Actinomycetaceae	*Schaalia*	*Schaalia suimastitidis*
Actinomycetota	Actinomycetaceae	*Schaalia*	*Schaalia vaccimaxillae*
Actinomycetota	Micrococcaceae	*Sinomonas*	*Sinomonas halotolerans*
Actinomycetota	Mycobacteriaceae	*Skermania*	*Skermania piniformis*
Actinomycetota	Solirubrobacteraceae	*Solirubrobacter*	*Solirubrobacter ginsenosidimutans*
Actinomycetota	Solirubrobacteraceae	*Solirubrobacter*	*Solirubrobacter soli*
Actinomycetota	Streptomycetaceae	*Streptacidiphilus*	*Streptacidiphilus carbonis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces abikoensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces acidiscabies*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces adustus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces aegyptia*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces albiaxialis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces albosporeus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces albulus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces anulatus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces atratus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces atriruber*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces aurantiacus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces avidinii*

Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces axinellae*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces azureus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces bacillaris*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces badius*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces baliensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces beijiangensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces bikiniensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces bobili*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces bryophytorum*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces burgazadensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces californicus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces cameroonensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces camponoticapitis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces candidus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces canescens*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces carminius*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces cavourensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces celluloflavus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces champavatii*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces cinereus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces cinnabarigriseus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces cinnamoneus*

Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces cirratus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces clavifer*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces clavuligerus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces coacervatus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces curacoi*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces cyaneus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces drozdowiczii*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces enissocaesilis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces finlayi*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces flavidovirens*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces flavofuscus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces flavovariabilis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces formicae*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces fradiae*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces fukangensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces fulvissimus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces fulvorobeus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces fuscichromogenes*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces galbus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces galilaeus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces gardneri*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces gelaticus*

Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces glauciniger*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces globisporus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces globosus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces graminisoli*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces graminofaciens*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces griseoruber*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces hiroshimensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces hygroscopicus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces intermedius*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces inusitatus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces kasugaensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces katrae*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces laurentii*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces lavendulae*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces lilacinus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces litmocidini*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces lushanensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces luteogriseus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces luteosporeus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces maoxianensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces melanogenes*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces mobaraensis*

Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces narbonensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces netropsis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces nitrosporeus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces niveus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces oceani*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces odonnellii*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces olivoreticuli*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces ovatisporus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces parvus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces peucetius*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces plicatus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces plumbiresistens*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces pluricolorescens*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces polyrhachis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces pratensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces pseudoechinosporeus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces pulveraceus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces purpureus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces racemochromogenes*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces rectiverticillatus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces rhizosphaerihabitans*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces rishiriensis*

Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces rubiginosohelvolus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces sampsonii*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces sanglieri*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces scopuliridis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces seoulensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces septatus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces sparsus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces spiralis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces sporoverrucosus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces stramineus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces subrutilus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces sudanensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces sundarbansensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces syringium*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces tanashiensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces termitum*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces vastus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces venezuelae*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces violaceorectus*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces virginiae*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces werraensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces xanthochromogenes*

Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces xiaopingdaonensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces yangpuensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces yatensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces yerevanensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces yunnanensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces zagrosensis*
Actinomycetota	Streptomycetaceae	*Streptomyces*	*Streptomyces zaomyceticus*
Actinomycetota	Streptosporangiaceae	*Streptosporangium*	*Streptosporangium nanhuense*
Actinomycetota	Dermatophilaceae	*Terrabacter*	*Terrabacter carboxydivorans*
Actinomycetota	Dermatophilaceae	*Terrabacter*	*Terrabacter ginsenosidimutans*
Actinomycetota	Dermatophilaceae	*Terrabacter*	*Terrabacter terrigena*
Actinomycetota	Propionibacteriaceae	*Tessaracoccus*	*Tessaracoccus aquimaris*
Actinomycetota	Propionibacteriaceae	*Tessaracoccus*	*Tessaracoccus defluvii*
Actinomycetota	Propionibacteriaceae	*Tessaracoccus*	*Tessaracoccus oleiagri*
Actinomycetota	Propionibacteriaceae	*Tessaracoccus*	*Tessaracoccus rhinocerotis*
Actinomycetota	Dermatophilaceae	*Tetrasphaera*	*Tetrasphaera duodecadis*
Actinomycetota	Dermatophilaceae	*Tetrasphaera*	*Tetrasphaera elongata*
Actinomycetota	Dermatophilaceae	*Tetrasphaera*	*Tetrasphaera japonica*
Actinomycetota	Thermoleophilaceae	*Thermoleophilum*	*Thermoleophilum minutum*
Actinomycetota	Mycobacteriaceae	*Williamsia*	*Williamsia serinedens*
Actinomycetota	Promicromonosporaceae	*Xylanimicrobium*	*Xylanimicrobium pachnodae*
Actinomycetota	Micrococcaceae	*Yaniella*	*Yaniella flava*

Aquificota	Desulfurobacteriaceae	*Desulfurobacterium*	*Desulfurobacterium indicum*
Armatimonadota	Fimbriimonadaceae	*Fimbriimonas*	*Fimbriimonas ginsengisoli*
Bacillota	Aerococcaceae	*Abiotrophia*	*Abiotrophia defectiva*
Bacillota	Staphylococcaceae	*Abyssicoccus*	*Abyssicoccus albus*
Bacillota	Lachnospiraceae	*Abyssivirga*	*Abyssivirga alkaniphila*
Bacillota	Ruminococcaceae	*Acetanaerobacterium*	*Acetanaerobacterium elongatum*
Bacillota	Lachnospiraceae	*Acetatifactor*	*Acetatifactor muris*
Bacillota	Lactobacillaceae	*Acetilactobacillus*	*Acetilactobacillus jinshanensis*
Bacillota	Acetivibrionaceae	*Acetivibrio*	*Acetivibrio aldrichii*
Bacillota	Acetivibrionaceae	*Acetivibrio*	*Acetivibrio alkalicellulosi*
Bacillota	Acetivibrionaceae	*Acetivibrio*	*Acetivibrio cellulolyticus*
Bacillota	Acetivibrionaceae	*Acetivibrio*	*Acetivibrio clariflavus*
Bacillota	Acetivibrionaceae	*Acetivibrio*	*Acetivibrio saccincola*
Bacillota	Acetivibrionaceae	*Acetivibrio*	*Acetivibrio straminisolvens*
Bacillota	Acetivibrionaceae	*Acetivibrio*	*Acetivibrio thermocellus*
Bacillota	Filifactoraceae	*Acetoanaerobium*	*Acetoanaerobium pronyense*
Bacillota	Filifactoraceae	*Acetoanaerobium*	*Acetoanaerobium sticklandii*
Bacillota	Eubacteriaceae	*Acetobacterium*	*Acetobacterium carbinolicum*
Bacillota	Eubacteriaceae	*Acetobacterium*	*Acetobacterium fimetarium*
Bacillota	Eubacteriaceae	*Acetobacterium*	*Acetobacterium paludosum*
Bacillota	Eubacteriaceae	*Acetobacterium*	*Acetobacterium tundrae*
Bacillota	Eubacteriaceae	*Acetobacterium*	*Acetobacterium wieringae*

Bacillota	Eubacteriaceae	*Acetobacterium*	*Acetobacterium woodii*
Bacillota	Acetonemaceae	*Acetonema*	*Acetonema longum*
Bacillota	Acholeplasmataceae	*Acholeplasma*	*Acholeplasma palmae*
Bacillota	Acidaminobacteraceae	*Acidaminobacter*	*Acidaminobacter hydrogenoformans*
Bacillota	Acutalibacteraceae	*Acutalibacter*	*Acutalibacter muris*
Bacillota	Aerococcaceae	*Aerococcus*	*Aerococcus christensenii*
Bacillota	Aerococcaceae	*Aerococcus*	*Aerococcus sanguinicola*
Bacillota	Aerococcaceae	*Aerococcus*	*Aerococcus suis*
Bacillota	Aerococcaceae	*Aerococcus*	*Aerococcus urinae*
Bacillota	Aerococcaceae	*Aerococcus*	*Aerococcus urinaeequi*
Bacillota	Aerococcaceae	*Aerococcus*	*Aerococcus urinaehominis*
Bacillota	Aerococcaceae	*Aerococcus*	*Aerococcus vaginalis*
Bacillota	Aerococcaceae	*Aerococcus*	*Aerococcus viridans*
Bacillota	Butyricicoccaceae	*Agathobaculum*	*Agathobaculum butyriciproducens*
Bacillota	Lactobacillaceae	*Agrilactobacillus*	*Agrilactobacillus composti*
Bacillota	Alicyclobacillaceae	*Alicyclobacillus*	*Alicyclobacillus contaminans*
Bacillota	Alicyclobacillaceae	*Alicyclobacillus*	*Alicyclobacillus fastidiosus*
Bacillota	Alicyclobacillaceae	*Alicyclobacillus*	*Alicyclobacillus pomorum*
Bacillota	Alicyclobacillaceae	*Alicyclobacillus*	*Alicyclobacillus shizuokensis*
Bacillota	Alkalibacillaceae	*Alkalibacillus*	*Alkalibacillus filiformis*
Bacillota	Alkalibacillaceae	*Alkalibacillus*	*Alkalibacillus haloalkaliphilus*
Bacillota	Alkalibacillaceae	*Alkalibacillus*	*Alkalibacillus silvisoli*

Bacillota	Alkalibacteraceae	*Alkalibacter*	*Alkalibacter saccharofermentans*
Bacillota	Carnobacteriaceae	*Alkalibacterium*	*Alkalibacterium gilvum*
Bacillota	Carnobacteriaceae	*Alkalibacterium*	*Alkalibacterium iburiense*
Bacillota	Carnobacteriaceae	*Alkalibacterium*	*Alkalibacterium indicireducens*
Bacillota	Carnobacteriaceae	*Alkalibacterium*	*Alkalibacterium olivapovliticus*
Bacillota	Carnobacteriaceae	*Alkalibacterium*	*Alkalibacterium pelagium*
Bacillota	Carnobacteriaceae	*Alkalibacterium*	*Alkalibacterium psychrotolerans*
Bacillota	Carnobacteriaceae	*Alkalibacterium*	*Alkalibacterium putridalgicola*
Bacillota	Carnobacteriaceae	*Alkalibacterium*	*Alkalibacterium subtropicum*
Bacillota	Carnobacteriaceae	*Alkalibacterium*	*Alkalibacterium thalassium*
Bacillota	Alkalibacteraceae	*Alkalibaculum*	*Alkalibaculum bacchi*
Bacillota	Salisediminibacteriaceae	*Alkalicoccus*	*Alkalicoccus chagannorensis*
Bacillota	Salisediminibacteriaceae	*Alkalicoccus*	*Alkalicoccus daliensis*
Bacillota	Bacillaceae	*Alkalihalobacillus*	*Alkalihalobacillus akibai*
Bacillota	Bacillaceae	*Alkalihalobacillus*	*Alkalihalobacillus alcalophilus*
Bacillota	Bacillaceae	*Alkalihalobacillus*	*Alkalihalobacillus algicola*
Bacillota	Bacillaceae	*Alkalihalobacillus*	*Alkalihalobacillus alkalisediminis*
Bacillota	Bacillaceae	*Alkalihalobacillus*	*Alkalihalobacillus bogoriensis*
Bacillota	Bacillaceae	*Alkalihalobacillus*	*Alkalihalobacillus caeni*
Bacillota	Bacillaceae	*Alkalihalobacillus*	*Alkalihalobacillus clausii*
Bacillota	Bacillaceae	*Alkalihalobacillus*	*Alkalihalobacillus gibsonii*
Bacillota	Bacillaceae	*Alkalihalobacillus*	*Alkalihalobacillus halodurans*

Bacillota	Bacillaceae	*Alkalihalobacillus*	*Alkalihalobacillus hemicellulosilyticus*
Bacillota	Bacillaceae	*Alkalihalobacillus*	*Alkalihalobacillus lehensis*
Bacillota	Bacillaceae	*Alkalihalobacillus*	*Alkalihalobacillus lindianensis*
Bacillota	Bacillaceae	*Alkalihalobacillus*	*Alkalihalobacillus murimartini*
Bacillota	Bacillaceae	*Alkalihalobacillus*	*Alkalihalobacillus okhensis*
Bacillota	Bacillaceae	*Alkalihalobacillus*	*Alkalihalobacillus pseudalcaliphilus*
Bacillota	Bacillaceae	*Alkalihalobacillus*	*Alkalihalobacillus pseudofirmus*
Bacillota	Bacillaceae	*Alkalihalobacillus*	*Alkalihalobacillus shacheensis*
Bacillota	Bacillaceae	*Alkalihalobacillus*	*Alkalihalobacillus trypoxylicola*
Bacillota	Bacillaceae	*Alkalihalobacillus*	*Alkalihalobacillus wakoensis*
Bacillota	Bacillaceae	*Alkalihalobacillus*	*Alkalihalobacillus xiaoxiensis*
Bacillota	Bacillaceae	*Alkalihalobacterium*	*Alkalihalobacterium elongatum*
Bacillota	Bacillaceae	*Alkalilactibacillus*	*Alkalilactibacillus ikkensis*
Bacillota	Natronincolaceae	*Alkaliphilus*	*Alkaliphilus crotonatoxidans*
Bacillota	Natronincolaceae	*Alkaliphilus*	*Alkaliphilus hydrothermalis*
Bacillota	Natronincolaceae	*Alkaliphilus*	*Alkaliphilus metalliredigens*
Bacillota	Natronincolaceae	*Alkaliphilus*	*Alkaliphilus namsaraevii*
Bacillota	Natronincolaceae	*Alkaliphilus*	*Alkaliphilus peptidifermentans*
Bacillota	Natronincolaceae	*Alkaliphilus*	*Alkaliphilus transvaalensis*
Bacillota	Carnobacteriaceae	*Alloiococcus*	*Alloiococcus otitis*
Bacillota	Incertae	*Altericista*	*Altericista lacusladogae*
Bacillota	Anaerovoracaceae	*Aminipila*	*Aminipila butyrica*

Bacillota	Amphibacillaceae	*Amphibacillus*	*Amphibacillus jilinensis*
Bacillota	Lactobacillaceae	*Amylolactobacillus*	*Amylolactobacillus amylophilus*
Bacillota	Lactobacillaceae	*Amylolactobacillus*	*Amylolactobacillus amylotrophicus*
Bacillota	Sporomusaceae	*Anaeroarcus*	*Anaeroarcus burkinensis*
Bacillota	Anaerobacillaceae	*Anaerobacillus*	*Anaerobacillus alkalidiazotrophicus*
Bacillota	Anaerobacillaceae	*Anaerobacillus*	*Anaerobacillus alkalilacustris*
Bacillota	Anaerobacillaceae	*Anaerobacillus*	*Anaerobacillus arseniciselenatis*
Bacillota	Acetivibrionaceae	*Anaerobacterium*	*Anaerobacterium chartisolvens*
Bacillota	Lachnospiraceae	*Anaerobium*	*Anaerobium acetethylicum*
Bacillota	Proteinivoraceae	*Anaerobranca*	*Anaerobranca horikoshii*
Bacillota	Helcococcaceae	*Anaerococcus*	*Anaerococcus prevotii*
Bacillota	Lachnospiraceae	*Anaerocolumna*	*Anaerocolumna aminovalerica*
Bacillota	Lachnospiraceae	*Anaerocolumna*	*Anaerocolumna cellulosilytica*
Bacillota	Lachnospiraceae	*Anaerocolumna*	*Anaerocolumna jejuensis*
Bacillota	Lachnospiraceae	*Anaerocolumna*	*Anaerocolumna xylanovorans*
Bacillota	Ruminococcaceae	*Anaerofilum*	*Anaerofilum agile*
Bacillota	Ruminococcaceae	*Anaerofilum*	*Anaerofilum pentosovorans*
Bacillota	Anaerofustaceae	*Anaerofustis*	*Anaerofustis stercorihominis*
Bacillota	Acutalibacteraceae	*Anaeromassilibacillus*	*Anaeromassilibacillus senegalensis*
Bacillota	Anaeromusaceae	*Anaeromusa*	*Anaeromusa acidaminophila*
Bacillota	Sporomusaceae	*Anaerosinus*	*Anaerosinus glycerini*
Bacillota	Thermosinaceae	*Anaerospora*	*Anaerospora hongkongensis*

Bacillota	Lachnospiraceae	*Anaerosporobacter*	*Anaerosporobacter mobilis*
Bacillota	Acetonemaceae	*Anaerosporomusa*	*Anaerosporomusa subterranea*
Bacillota	Lachnospiraceae	*Anaerostipes*	*Anaerostipes butyraticus*
Bacillota	Lachnospiraceae	*Anaerostipes*	*Anaerostipes caccae*
Bacillota	Lachnospiraceae	*Anaerostipes*	*Anaerostipes hadrus*
Bacillota	Lachnospiraceae	*Anaerotaenia*	*Anaerotaenia torta*
Bacillota	Eubacteriaceae	*Anaerotalea*	*Anaerotalea alkaliphila*
Bacillota	Anaerotignaceae	*Anaerotignum*	*Anaerotignum aminivorans*
Bacillota	Anaerotignaceae	*Anaerotignum*	*Anaerotignum faecicola*
Bacillota	Anaerotignaceae	*Anaerotignum*	*Anaerotignum lactatifermentans*
Bacillota	Anaerotignaceae	*Anaerotignum*	*Anaerotignum neopropionicum*
Bacillota	Anaerotignaceae	*Anaerotignum*	*Anaerotignum propionicum*
Bacillota	Ruminococcaceae	*Anaerotruncus*	*Anaerotruncus colihominis*
Bacillota	Ruminococcaceae	*Anaerotruncus*	*Anaerotruncus rubiinfantis*
Bacillota	Anaerovoracaceae	*Anaerovorax*	*Anaerovorax odorimutans*
Bacillota	Incertae	*Ancylothrix*	*Ancylothrix rivularis*
Bacillota	Gottschalkiaceae	*Andreesenia*	*Andreesenia angusta*
Bacillota	Aneurinibacillaceae	*Aneurinibacillus*	*Aneurinibacillus aneurinilyticus*
Bacillota	Aneurinibacillaceae	*Aneurinibacillus*	*Aneurinibacillus danicus*
Bacillota	Aneurinibacillaceae	*Aneurinibacillus*	*Aneurinibacillus migulanus*
Bacillota	Aneurinibacillaceae	*Aneurinibacillus*	*Aneurinibacillus sediminis*
Bacillota	Aneurinibacillaceae	*Aneurinibacillus*	*Aneurinibacillus soli*

Bacillota	Aneurinibacillaceae	*Aneurinibacillus*	*Aneurinibacillus thermoaerophilus*
Bacillota	Aneurinibacillaceae	*Aneurinibacillus*	*Aneurinibacillus tyrosinisolvens*
Bacillota	Anoxybacillaceae	*Anoxybacillus*	*Anoxybacillus amylolyticus*
Bacillota	Anoxybacillaceae	*Anoxybacillus*	*Anoxybacillus caldiproteolyticus*
Bacillota	Anoxybacillaceae	*Anoxybacillus*	*Anoxybacillus calidus*
Bacillota	Anoxybacillaceae	*Anoxybacillus*	*Anoxybacillus contaminans*
Bacillota	Anoxybacillaceae	*Anoxybacillus*	*Anoxybacillus eryuanensis*
Bacillota	Anoxybacillaceae	*Anoxybacillus*	*Anoxybacillus flavithermus*
Bacillota	Anoxybacillaceae	*Anoxybacillus*	*Anoxybacillus geothermalis*
Bacillota	Anoxybacillaceae	*Anoxybacillus*	*Anoxybacillus kaynarcensis*
Bacillota	Anoxybacillaceae	*Anoxybacillus*	*Anoxybacillus kestanbolensis*
Bacillota	Anoxybacillaceae	*Anoxybacillus*	*Anoxybacillus thermarum*
Bacillota	Anoxybacillaceae	*Anoxybacillus*	*Anoxybacillus vitaminiphilus*
Bacillota	Clostridiaceae	*Anoxynatronum*	*Anoxynatronum buryatiense*
Bacillota	Lactobacillaceae	*Apilactobacillus*	*Apilactobacillus apinorum*
Bacillota	Lactobacillaceae	*Apilactobacillus*	*Apilactobacillus kunkeei*
Bacillota	Lactobacillaceae	*Apilactobacillus*	*Apilactobacillus ozensis*
Bacillota	Amphibacillaceae	*Aquibacillus*	*Aquibacillus halophilus*
Bacillota	Peptostreptococcaceae	*Asaccharospora*	*Asaccharospora irregularis*
Bacillota	Aerococcaceae	*Atopobacter*	*Atopobacter phocae*
Bacillota	Carnobacteriaceae	*Atopostipes*	*Atopostipes suicloacalis*
Bacillota	Bacillaceae	*Aureibacillus*	*Aureibacillus halotolerans*

Bacillota	Bacillaceae	*Bacillus*	*Bacillus acidiceler*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus acidicola*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus aeolius*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus aerius*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus aerophilus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus akibai*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus alcalophilus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus algicola*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus alkalisediminis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus alkalitelluris*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus alkalitolerans*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus altitudinis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus alveayuensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus amyloliquefaciens*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus andreraoultii*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus aquiflavi*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus aquimaris*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus aryabhattai*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus asahii*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus atrophaeus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus australimaris*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus azotoformans*

Bacillota	Bacillaceae	*Bacillus*	*Bacillus badius*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus bataviensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus benzoevorans*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus beringensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus berkeleyi*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus bingmayongensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus borbori*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus capparidis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus carboniphilus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus cavernae*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus cecembensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus cellulosilyticus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus cereus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus chungangensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus ciccensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus circulans*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus clausii*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus coagulans*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus coahuilensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus cohnii*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus cytotoxicus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus dakarensis*

Bacillota	Bacillaceae	*Bacillus*	*Bacillus decolorationis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus deserti*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus drentensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus ectoiniformans*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus eiseniae*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus enclensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus endoradicis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus fastidiosus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus fermenti*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus firmus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus flexus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus foraminis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus fungorum*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus funiculus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus gaemokensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus galliciensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus ginsengihumi*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus ginsengisoli*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus gossypii*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus gottheilii*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus haikouensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus halmapalus*

Bacillota	Bacillaceae	*Bacillus*	*Bacillus halodurans*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus halosaccharovorans*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus halotolerans*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus haynesii*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus hemicellulosilyticus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus herbersteinensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus horikoshii*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus horneckiae*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus horti*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus huizhouensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus humi*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus hwajinpoensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus idriensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus indicus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus infantis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus infernus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus iocasae*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus isabeliae*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus kexueae*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus kochii*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus koreensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus korlensis*

Bacillota	Bacillaceae	*Bacillus*	*Bacillus kribbensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus lacus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus lehensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus lentus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus licheniformis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus lindianensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus litoralis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus lonarensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus luciferensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus lycopersici*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus malikii*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus mangrovi*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus manliponensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus mannanilyticus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus manusensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus marasmi*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus marcorestinctum*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus marinisedimentorum*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus marisflavi*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus maritimus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus massilioanorexius*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus massiliogorillae*

Bacillota	Bacillaceae	*Bacillus*	*Bacillus mediterraneensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus megaterium*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus mesophilus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus methanolicus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus mobilis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus muralis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus murimartini*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus mycoides*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus nakamurai*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus nealsonii*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus nematocida*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus niabensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus niacini*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus niameyensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus notoginsengisoli*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus novalis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus oceani*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus oceanisediminis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus okuhidensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus oleivorans*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus oleronius*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus oryzaecorticis*

Bacillota	Bacillaceae	*Bacillus*	*Bacillus oryzisoli*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus oryziterrae*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus pacificus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus pakistanensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus panacisoli*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus panaciterrae*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus paraflexus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus paramycoides*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus paranthracis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus persicus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus pervagus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus pocheonensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus polygoni*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus praedii*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus proteolyticus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus pseudalcaliphilus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus pseudofirmus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus pseudomycoides*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus psychrosaccharolyticus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus purgationiresistens*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus racemilacticus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus rubiinfantis*

Bacillota	Bacillaceae	*Bacillus*	*Bacillus safensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus salarius*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus salitolerans*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus selenitireducens*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus shacheensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus shackletonii*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus siamensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus simplex*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus smithii*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus solisilvae*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus songklensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus spongiae*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus sporothermodurans*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus stamsii*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus stratosphericus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus stratosphericus;Bacillus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus subtilis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus swezeyi*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus taiwanensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus tamaricis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus tequilensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus terrae*

Bacillota	Bacillaceae	*Bacillus*	*Bacillus testis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus thermocloacae*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus thermocopriae*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus thuringiensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus tianmuensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus tianshenii*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus timonensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus toyonensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus tropicus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus tropicus;Bacillus*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus trypoxylicola*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus vallismortis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus velezensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus wakoensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus wiedmannii*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus wudalianchiensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus wuyishanensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus xiamenensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus xiaoxiensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus xiapuensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus yapensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus zeae*

Bacillota	Bacillaceae	*Bacillus*	*Bacillus zhangzhouensis*
Bacillota	Bacillaceae	*Bacillus*	*Bacillus zhanjiangensis*
Bacillota	Thermoactinomycetaceae	*Baia*	*Baia soyae*
Bacillota	Lachnospiraceae	*Bariatricus*	*Bariatricus massiliensis*
Bacillota	Aerococcaceae	*Bavariicoccus*	*Bavariicoccus seileri*
Bacillota	Planococcaceae	*Bhargavaea*	*Bhargavaea beijingensis*
Bacillota	Planococcaceae	*Bhargavaea*	*Bhargavaea cecembensis*
Bacillota	Planococcaceae	*Bhargavaea*	*Bhargavaea ginsengi*
Bacillota	Planococcaceae	*Bhargavaea*	*Bhargavaea indica*
Bacillota	Lachnospiraceae	*Blautia*	*Blautia argi*
Bacillota	Lachnospiraceae	*Blautia*	*Blautia coccoides*
Bacillota	Lachnospiraceae	*Blautia*	*Blautia faecicola*
Bacillota	Lachnospiraceae	*Blautia*	*Blautia glucerasea*
Bacillota	Lachnospiraceae	*Blautia*	*Blautia hansenii*
Bacillota	Lachnospiraceae	*Blautia*	*Blautia hominis*
Bacillota	Lachnospiraceae	*Blautia*	*Blautia hydrogenotrophica*
Bacillota	Lachnospiraceae	*Blautia*	*Blautia luti*
Bacillota	Lachnospiraceae	*Blautia*	*Blautia marasmi*
Bacillota	Lachnospiraceae	*Blautia*	*Blautia obeum*
Bacillota	Lachnospiraceae	*Blautia*	*Blautia producta*
Bacillota	Lachnospiraceae	*Blautia*	*Blautia schinkii*
Bacillota	Lachnospiraceae	*Blautia*	*Blautia stercoris*

Bacillota	Lactobacillaceae	*Bombilactobacillus*	*Bombilactobacillus bombi*
Bacillota	Lactobacillaceae	*Bombilactobacillus*	*Bombilactobacillus mellifer*
Bacillota	Lactobacillaceae	*Bombilactobacillus*	*Bombilactobacillus mellis*
Bacillota	Thermohalobacteraceae	*Brassicibacter*	*Brassicibacter mesophilus*
Bacillota	Thermohalobacteraceae	*Brassicibacter*	*Brassicibacter thermophilus*
Bacillota	Brevibacillaceae	*Brevibacillus*	*Brevibacillus borstelensis*
Bacillota	Brevibacillaceae	*Brevibacillus*	*Brevibacillus choshinensis*
Bacillota	Brevibacillaceae	*Brevibacillus*	*Brevibacillus laterosporus*
Bacillota	Brevibacillaceae	*Brevibacillus*	*Brevibacillus nitrificans*
Bacillota	Brevibacillaceae	*Brevibacillus*	*Brevibacillus reuszeri*
Bacillota	Brevibacillaceae	*Brevibacillus*	*Brevibacillus thermoruber*
Bacillota	Erysipelotrichaceae	*Breznakia*	*Breznakia blatticola*
Bacillota	Erysipelotrichaceae	*Breznakia*	*Breznakia pachnodae*
Bacillota	Brochotrichaceae	*Brochothrix*	*Brochothrix campestris*
Bacillota	Brochotrichaceae	*Brochothrix*	*Brochothrix thermosphacta*
Bacillota	Butyricicoccaceae	*Butyricicoccus*	*Butyricicoccus faecihominis*
Bacillota	Butyricicoccaceae	*Butyricicoccus*	*Butyricicoccus pullicaecorum*
Bacillota	Lachnospiraceae	*Caecibacterium*	*Caecibacterium sporoformans*
Bacillota	Caldalkalibacillaceae	*Caldalkalibacillus*	*Caldalkalibacillus mannanilyticus*
Bacillota	Caldalkalibacillaceae	*Caldalkalibacillus*	*Caldalkalibacillus thermarum*
Bacillota	Caldibacillaceae	*Caldibacillus*	*Caldibacillus kokeshiiformis*
Bacillota	Caldibacillaceae	*Caldibacillus*	*Caldibacillus thermoamylovorans*

Bacillota	Caldibacillaceae	*Caldibacillus*	*Caldibacillus thermolactis*
Bacillota	Caldicellulosiruptoraceae	*Caldicellulosiruptor*	*Caldicellulosiruptor acetigenus*
Bacillota	Caldicoprobacteraceae	*Caldicoprobacter*	*Caldicoprobacter faecalis*
Bacillota	Caldicoprobacteraceae	*Caldicoprobacter*	*Caldicoprobacter guelmensis*
Bacillota	Caloramatoraceae	*Caloramator*	*Caloramator australicus*
Bacillota	Caloramatoraceae	*Caloramator*	*Caloramator mitchellensis*
Bacillota	Caloranaerobacteraceae	*Caloranaerobacter*	*Caloranaerobacter azorensis*
Bacillota	Caloranaerobacteraceae	*Caloranaerobacter*	*Caloranaerobacter ferrireducens*
Bacillota	Caminicellaceae	*Caminicella*	*Caminicella sporogenes*
Bacillota	Acutalibacteraceae	*Caproiciproducens*	*Caproiciproducens galactitolivorans*
Bacillota	Carnobacteriaceae	*Carnobacterium*	*Carnobacterium alterfunditum*
Bacillota	Carnobacteriaceae	*Carnobacterium*	*Carnobacterium divergens*
Bacillota	Carnobacteriaceae	*Carnobacterium*	*Carnobacterium funditum*
Bacillota	Carnobacteriaceae	*Carnobacterium*	*Carnobacterium gallinarum*
Bacillota	Carnobacteriaceae	*Carnobacterium*	*Carnobacterium iners*
Bacillota	Carnobacteriaceae	*Carnobacterium*	*Carnobacterium inhibens*
Bacillota	Carnobacteriaceae	*Carnobacterium*	*Carnobacterium jeotgali*
Bacillota	Carnobacteriaceae	*Carnobacterium*	*Carnobacterium maltaromaticum*
Bacillota	Carnobacteriaceae	*Carnobacterium*	*Carnobacterium mobile*
Bacillota	Carnobacteriaceae	*Carnobacterium*	*Carnobacterium pleistocenium*
Bacillota	Carnobacteriaceae	*Carnobacterium*	*Carnobacterium viridans*
Bacillota	Planococcaceae	*Caryophanon*	*Caryophanon latum*

Bacillota	Eubacteriaceae	*Casaltella*	*Casaltella massiliensis*
Bacillota	Christensenellaceae	*Catabacter*	*Catabacter hongkongensis*
Bacillota	Catellicoccaceae	*Catellicoccus*	*Catellicoccus marimammalium*
Bacillota	Cellulosilyticaceae	*Cellulosilyticum*	*Cellulosilyticum lentocellum*
Bacillota	Cellulosilyticaceae	*Cellulosilyticum*	*Cellulosilyticum ruminicola*
Bacillota	Paenibacillaceae	*Chengkuizengella*	*Chengkuizengella sediminis*
Bacillota	Christensenellaceae	*Christensenella*	*Christensenella hongkongensis*
Bacillota	Christensenellaceae	*Christensenella*	*Christensenella massiliensis*
Bacillota	Christensenellaceae	*Christensenella*	*Christensenella minuta*
Bacillota	Christensenellaceae	*Christensenella*	*Christensenella timonensis*
Bacillota	Planococcaceae	*Chryseomicrobium*	*Chryseomicrobium deserti*
Bacillota	Planococcaceae	*Chryseomicrobium*	*Chryseomicrobium palamuruense*
Bacillota	Peptostreptococcaceae	*Clostridioides*	*Clostridioides difficile*
Bacillota	Peptostreptococcaceae	*Clostridioides*	*Clostridioides mangenotii*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium acetireducens*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium acidisoli*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium aciditolerans*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium aerotolerans*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium aestuarii*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium akagii*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium algidicarnis*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium algidixylanolyticum*

Bacillota	Clostridiaceae	*Clostridium*	*Clostridium algifaecis*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium amazonense*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium amygdalinum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium amylolyticum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium arbusti*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium argentinense*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium aurantibutyricum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium autoethanogenum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium baratii*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium beijerinckii*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium bolteae*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium bornimense*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium botulinum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium bowmanii*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium budayi*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium butyricum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium cadaveris*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium carboxidivorans*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium carnis*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium cavendishii*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium celatum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium celerecrescens*

Bacillota	Clostridiaceae	*Clostridium*	*Clostridium cellulosi*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium cellulovorans*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium chartatabidum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium chauvoei*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium chromiireducens*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium citroniae*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium clostridioforme*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium cochlearium*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium cocleatum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium colicanis*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium colinum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium collagenovorans*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium combesii*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium cylindrosporum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium dakarense*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium diolis*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium disporicum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium drakei*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium estertheticum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium fallax*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium felsineum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium fermenticellae*

Bacillota	Clostridiaceae	*Clostridium*	*Clostridium fimetarium*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium frigidicarnis*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium frigoris*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium ganghwense*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium gasigenes*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium glycyrrhizinilyticum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium grantii*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium haemolyticum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium herbivorans*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium hiranonis*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium homopropionicum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium hydrogeniformans*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium hylemonae*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium ihumii*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium indolis*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium innocuum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium intestinale*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium isatidis*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium jeddahense*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium kogasensis*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium lavalense*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium leptum*

Bacillota	Clostridiaceae	*Clostridium*	*Clostridium liquoris*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium ljungdahlii*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium lundense*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium magnum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium malenominatum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium massiliodielmoense*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium maximum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium merdae*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium methylpentosum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium moniliforme*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium nitritogenes*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium nitrophenolicum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium novyi*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium oceanicum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium oryzae*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium paradoxum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium paraputrificum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium pascui*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium pasteurianum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium perfringens*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium polyendosporum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium polynesiense*

Bacillota	Clostridiaceae	*Clostridium*	*Clostridium polysaccharolyticum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium populeti*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium punense*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium puniceum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium putrefaciens*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium quinii*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium roseum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium saccharobutylicum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium saccharogumia*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium saccharolyticum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium saccharoperbutylacetonicum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium sardiniense*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium sartagoforme*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium saudiense*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium scatologenes*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium schirmacherense*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium scindens*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium senegalense*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium septicum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium sphenoides*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium spiroforme*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium sporogenes*

Bacillota	Clostridiaceae	*Clostridium*	*Clostridium subterminale*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium swellfunianum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium symbiosum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium tagluense*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium tarantellae*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium tepidiprofundi*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium tepidum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium tertium*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium tetani*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium tetanomorphum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium thermoalcaliphilum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium thermobutyricum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium thermopalmarium*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium tunisiense*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium uliginosum*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium ventriculi*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium vincentii*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium viride*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium vulturis*
Bacillota	Clostridiaceae	*Clostridium*	*Clostridium xylanolyticum*
Bacillota	Paenibacillaceae	*Cohnella*	*Cohnella boryungensis*
Bacillota	Paenibacillaceae	*Cohnella*	*Cohnella collisoli*

Bacillota	Paenibacillaceae	*Cohnella*	*Cohnella damuensis*
Bacillota	Paenibacillaceae	*Cohnella*	*Cohnella endophytica*
Bacillota	Paenibacillaceae	*Cohnella*	*Cohnella formosensis*
Bacillota	Paenibacillaceae	*Cohnella*	*Cohnella humi*
Bacillota	Paenibacillaceae	*Cohnella*	*Cohnella lubricantis*
Bacillota	Paenibacillaceae	*Cohnella*	*Cohnella lupini*
Bacillota	Paenibacillaceae	*Cohnella*	*Cohnella panacarvi*
Bacillota	Paenibacillaceae	*Cohnella*	*Cohnella phaseoli*
Bacillota	Paenibacillaceae	*Cohnella*	*Cohnella saccharovorans*
Bacillota	Eubacteriaceae	*Colidextribacter*	*Colidextribacter massiliensis*
Bacillota	Lactobacillaceae	*Companilactobacillus*	*Companilactobacillus alimentarius*
Bacillota	Lactobacillaceae	*Companilactobacillus*	*Companilactobacillus allii*
Bacillota	Lactobacillaceae	*Companilactobacillus*	*Companilactobacillus bobalius*
Bacillota	Lactobacillaceae	*Companilactobacillus*	*Companilactobacillus crustorum*
Bacillota	Lactobacillaceae	*Companilactobacillus*	*Companilactobacillus farciminis*
Bacillota	Lactobacillaceae	*Companilactobacillus*	*Companilactobacillus furfuricola*
Bacillota	Lactobacillaceae	*Companilactobacillus*	*Companilactobacillus futsaii*
Bacillota	Lactobacillaceae	*Companilactobacillus*	*Companilactobacillus ginsenosidimutans*
Bacillota	Lactobacillaceae	*Companilactobacillus*	*Companilactobacillus insicii*
Bacillota	Lactobacillaceae	*Companilactobacillus*	*Companilactobacillus kimchiensis*
Bacillota	Lactobacillaceae	*Companilactobacillus*	*Companilactobacillus kimchii*
Bacillota	Lactobacillaceae	*Companilactobacillus*	*Companilactobacillus mindensis*

Bacillota	Lactobacillaceae	*Companilactobacillus*	*Companilactobacillus musae*
Bacillota	Lactobacillaceae	*Companilactobacillus*	*Companilactobacillus nantensis*
Bacillota	Lactobacillaceae	*Companilactobacillus*	*Companilactobacillus nodensis*
Bacillota	Lactobacillaceae	*Companilactobacillus*	*Companilactobacillus paralimentarius*
Bacillota	Lactobacillaceae	*Companilactobacillus*	*Companilactobacillus tucceti*
Bacillota	Lactobacillaceae	*Companilactobacillus*	*Companilactobacillus versmoldensis*
Bacillota	Lactobacillaceae	*Convivina*	*Convivina intestini*
Bacillota	Erysipelatoclostridiaceae	*Coprobacillus*	*Coprobacillus cateniformis*
Bacillota	Lachnospiraceae	*Coprococcus*	*Coprococcus comes*
Bacillota	Staphylococcaceae	*Corticicoccus*	*Corticicoccus populi*
Bacillota	Clostridiaceae	*Crassaminicella*	*Crassaminicella profunda*
Bacillota	Thermoactinomycetaceae	*Croceifilum*	*Croceifilum oryzae*
Bacillota	Lachnospiraceae	*Cuneatibacter*	*Cuneatibacter caecimuris*
Bacillota	Bacillaceae	*Cytobacillus*	*Cytobacillus ciccensis*
Bacillota	Bacillaceae	*Cytobacillus*	*Cytobacillus depressus*
Bacillota	Bacillaceae	*Cytobacillus*	*Cytobacillus eiseniae*
Bacillota	Bacillaceae	*Cytobacillus*	*Cytobacillus firmus*
Bacillota	Bacillaceae	*Cytobacillus*	*Cytobacillus gottheilii*
Bacillota	Bacillaceae	*Cytobacillus*	*Cytobacillus horneckiae*
Bacillota	Bacillaceae	*Cytobacillus*	*Cytobacillus kochii*
Bacillota	Bacillaceae	*Cytobacillus*	*Cytobacillus purgationiresistens*
Bacillota	Defluviitaleaceae	*Defluviitalea*	*Defluviitalea raffinosedens*

Bacillota	Defluviitaleaceae	*Defluviitalea*	*Defluviitalea saccharophila*
Bacillota	Syntrophobotulaceae	*Dehalobacter*	*Dehalobacter restrictus*
Bacillota	Lactobacillaceae	*Dellaglioa*	*Dellaglioa algida*
Bacillota	Dendrosporobacteraceae	*Dendrosporobacter*	*Dendrosporobacter quercicolus*
Bacillota	Carnobacteriaceae	*Desemzia*	*Desemzia incerta*
Bacillota	Clostridiaceae	*Desnuesiella*	*Desnuesiella massiliensis*
Bacillota	Desulfallaceae	*Desulfallas*	*Desulfallas geothermicus*
Bacillota	Peptococcaceae	*Desulfitispora*	*Desulfitispora alkaliphila*
Bacillota	Peptococcaceae	*Desulfitispora*	*Desulfitispora elongata*
Bacillota	Desulfitobacteriaceae	*Desulfitobacterium*	*Desulfitobacterium chlororespirans*
Bacillota	Desulfitobacteriaceae	*Desulfitobacterium*	*Desulfitobacterium dehalogenans*
Bacillota	Desulfitobacteriaceae	*Desulfitobacterium*	*Desulfitobacterium hafniense*
Bacillota	Desulfitobacteriaceae	*Desulfitobacterium*	*Desulfitobacterium metallireducens*
Bacillota	Desulfocucumaceae	*Desulfocucumis*	*Desulfocucumis palustris*
Bacillota	Desulfofarciminaceae	*Desulfofarcimen*	*Desulfofarcimen intricatum*
Bacillota	Desulfovirgulaceae	*Desulfofundulus*	*Desulfofundulus thermobenzoicus*
Bacillota	Desulfotomaculaceae	*Desulfohalotomaculum*	*Desulfohalotomaculum alkaliphilum*
Bacillota	Desulfotomaculaceae	*Desulfohalotomaculum*	*Desulfohalotomaculum halophilum*
Bacillota	Desulfotomaculaceae	*Desulfohalotomaculum*	*Desulfohalotomaculum peckii*
Bacillota	Desulfonisporaceae	*Desulfonispora*	*Desulfonispora thiosulfatigenes*
Bacillota	Desulfitobacteriaceae	*Desulfosporosinus*	*Desulfosporosinus acididurans*
Bacillota	Desulfitobacteriaceae	*Desulfosporosinus*	*Desulfosporosinus acidiphilus*

Bacillota	Desulfitobacteriaceae	*Desulfosporosinus*	*Desulfosporosinus auripigmenti*
Bacillota	Desulfitobacteriaceae	*Desulfosporosinus*	*Desulfosporosinus fructosivorans*
Bacillota	Desulfitobacteriaceae	*Desulfosporosinus*	*Desulfosporosinus hippei*
Bacillota	Desulfitobacteriaceae	*Desulfosporosinus*	*Desulfosporosinus lacus*
Bacillota	Desulfitobacteriaceae	*Desulfosporosinus*	*Desulfosporosinus meridiei*
Bacillota	Desulfitobacteriaceae	*Desulfosporosinus*	*Desulfosporosinus nitroreducens*
Bacillota	Desulfitobacteriaceae	*Desulfosporosinus*	*Desulfosporosinus orientis*
Bacillota	Desulfitobacteriaceae	*Desulfosporosinus*	*Desulfosporosinus youngiae*
Bacillota	Thermoanaerobacteraceae	*Desulfothermobacter*	*Desulfothermobacter acidiphilus*
Bacillota	Desulfotomaculaceae	*Desulfotomaculum*	*Desulfotomaculum aeronauticum*
Bacillota	Desulfotomaculaceae	*Desulfotomaculum*	*Desulfotomaculum guttoideum*
Bacillota	Desulfotomaculaceae	*Desulfotomaculum*	*Desulfotomaculum reducens*
Bacillota	Desulfotomaculaceae	*Desulfotomaculum*	*Desulfotomaculum salinum*
Bacillota	Desulfuribacillaceae	*Desulfuribacillus*	*Desulfuribacillus alkaliarsenatis*
Bacillota	Dialisteraceae	*Dialister*	*Dialister invisus*
Bacillota	Dialisteraceae	*Dialister*	*Dialister micraerophilus*
Bacillota	Aerococcaceae	*Dolosicoccus*	*Dolosicoccus paucivorans*
Bacillota	Domibacillaceae	*Domibacillus*	*Domibacillus antri*
Bacillota	Domibacillaceae	*Domibacillus*	*Domibacillus epiphyticus*
Bacillota	Domibacillaceae	*Domibacillus*	*Domibacillus indicus*
Bacillota	Domibacillaceae	*Domibacillus*	*Domibacillus iocasae*
Bacillota	Domibacillaceae	*Domibacillus*	*Domibacillus mangrovi*

Bacillota	Domibacillaceae	*Domibacillus*	*Domibacillus robiginosus*
Bacillota	Domibacillaceae	*Domibacillus*	*Domibacillus tundrae*
Bacillota	Lachnospiraceae	*Dorea*	*Dorea formicigenerans*
Bacillota	Bacillaceae	*Ectobacillus*	*Ectobacillus funiculus*
Bacillota	Bacillaceae	*Ectobacillus*	*Ectobacillus panaciterrae*
Bacillota	Effusibacillaceae	*Effusibacillus*	*Effusibacillus consociatus*
Bacillota	Lachnospiraceae	*Eisenbergiella*	*Eisenbergiella massiliensis*
Bacillota	Lachnospiraceae	*Eisenbergiella*	*Eisenbergiella tayi*
Bacillota	Anaerovoracaceae	*Emergencia*	*Emergencia timonensis*
Bacillota	Lachnospiraceae	*Enterocloster*	*Enterocloster aldenensis*
Bacillota	Lachnospiraceae	*Enterocloster*	*Enterocloster asparagiformis*
Bacillota	Lachnospiraceae	*Enterocloster*	*Enterocloster bolteae*
Bacillota	Lachnospiraceae	*Enterocloster*	*Enterocloster citroniae*
Bacillota	Lachnospiraceae	*Enterocloster*	*Enterocloster clostridioformis*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus alcedinis*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus aquimarinus*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus asini*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus avium*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus bulliens*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus camelliae*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus canintestini*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus canis*

Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus casseliflavus*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus cecorum*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus columbae*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus crotali*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus devriesei*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus diestrammenae*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus dispar*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus durans*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus eurekensis*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus faecalis*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus faecium*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus gallinarum*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus gilvus*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus haemoperoxidus*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus hermanniensis*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus hirae*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus italicus*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus lactis*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus lemanii*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus malodoratus*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus massiliensis*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus moraviensis*

Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus mundtii*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus olivae*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus pallens*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus phoeniculicola*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus plantarum*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus pseudoavium*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus raffinosus*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus ratti*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus rivorum*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus rotai*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus saccharolyticus*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus saigonensis*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus silesiacus*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus sulfureus*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus termitis*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus thailandicus*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus ureasiticus*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus ureilyticus*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus viikkiensis*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus villorum*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus wangshanyuanii*
Bacillota	Enterococcaceae	*Enterococcus*	*Enterococcus xiangfangensis*

Bacillota	Oscillospiraceae	*Ercella*	*Ercella succinigenes*
Bacillota	Aerococcaceae	*Eremococcus*	*Eremococcus coleocola*
Bacillota	Erysipelatoclostridiaceae	*Erysipelatoclostridium*	*Erysipelatoclostridium ramosum*
Bacillota	Erysipelotrichaceae	*Erysipelothrix*	*Erysipelothrix inopinata*
Bacillota	Erysipelotrichaceae	*Erysipelothrix*	*Erysipelothrix larvae*
Bacillota	Ethanoligenenaceae	*Ethanoligenens*	*Ethanoligenens harbinense*
Bacillota	Eubacteriaceae	*Eubacterium*	*Eubacterium barkeri*
Bacillota	Eubacteriaceae	*Eubacterium*	*Eubacterium brachy*
Bacillota	Eubacteriaceae	*Eubacterium*	*Eubacterium callanderi*
Bacillota	Eubacteriaceae	*Eubacterium*	*Eubacterium coprostanoligenes*
Bacillota	Eubacteriaceae	*Eubacterium*	*Eubacterium eligens*
Bacillota	Eubacteriaceae	*Eubacterium*	*Eubacterium infirmum*
Bacillota	Eubacteriaceae	*Eubacterium*	*Eubacterium limosum*
Bacillota	Eubacteriaceae	*Eubacterium*	*Eubacterium minutum*
Bacillota	Eubacteriaceae	*Eubacterium*	*Eubacterium multiforme*
Bacillota	Eubacteriaceae	*Eubacterium*	*Eubacterium nodatum*
Bacillota	Eubacteriaceae	*Eubacterium*	*Eubacterium oxidoreducens*
Bacillota	Eubacteriaceae	*Eubacterium*	*Eubacterium pyruvativorans*
Bacillota	Eubacteriaceae	*Eubacterium*	*Eubacterium ramulus*
Bacillota	Eubacteriaceae	*Eubacterium*	*Eubacterium rectale*
Bacillota	Eubacteriaceae	*Eubacterium*	*Eubacterium ruminantium*
Bacillota	Eubacteriaceae	*Eubacterium*	*Eubacterium siraeum*

Bacillota	Eubacteriaceae	*Eubacterium*	*Eubacterium sulci*
Bacillota	Eubacteriaceae	*Eubacterium*	*Eubacterium tenue*
Bacillota	Eubacteriaceae	*Eubacterium*	*Eubacterium uniforme*
Bacillota	Eubacteriaceae	*Eubacterium*	*Eubacterium ventriosum*
Bacillota	Eubacteriaceae	*Eubacterium*	*Eubacterium xylanophilum*
Bacillota	Bacillaceae	*Evansella*	*Evansella cellulosilytica*
Bacillota	Bacillaceae	*Evansella*	*Evansella vedderi*
Bacillota	Exiguobacteraceae	*Exiguobacterium*	*Exiguobacterium acetylicum*
Bacillota	Exiguobacteraceae	*Exiguobacterium*	*Exiguobacterium antarcticum*
Bacillota	Exiguobacteraceae	*Exiguobacterium*	*Exiguobacterium artemiae*
Bacillota	Exiguobacteraceae	*Exiguobacterium*	*Exiguobacterium aurantiacum*
Bacillota	Exiguobacteraceae	*Exiguobacterium*	*Exiguobacterium soli*
Bacillota	Exiguobacteraceae	*Exiguobacterium*	*Exiguobacterium undae*
Bacillota	Incertae	*Exilispira*	*Exilispira thermophila*
Bacillota	Lachnospiraceae	*Extibacter*	*Extibacter muris*
Bacillota	Aerococcaceae	*Facklamia*	*Facklamia hominis*
Bacillota	Aerococcaceae	*Facklamia*	*Facklamia languida*
Bacillota	Aerococcaceae	*Facklamia*	*Facklamia miroungae*
Bacillota	Aerococcaceae	*Facklamia*	*Facklamia sourekii*
Bacillota	Aerococcaceae	*Facklamia*	*Facklamia tabacinasalis*
Bacillota	Ruminococcaceae	*Faecalibacterium*	*Faecalibacterium prausnitzii*
Bacillota	Lachnospiraceae	*Faecalicatena*	*Faecalicatena contorta*

Bacillota	Lachnospiraceae	*Faecalicatena*	*Faecalicatena fissicatena*
Bacillota	Lachnospiraceae	*Faecalicatena*	*Faecalicatena orotica*
Bacillota	Lachnospiraceae	*Faecalimonas*	*Faecalimonas umbilicata*
Bacillota	Clostridiaceae	*Falcatimonas*	*Falcatimonas natans*
Bacillota	Bacillaceae	*Falsibacillus*	*Falsibacillus albus*
Bacillota	Bacillaceae	*Falsibacillus*	*Falsibacillus pallidus*
Bacillota	Bacillaceae	*Fermentibacillus*	*Fermentibacillus polygoni*
Bacillota	Caloramatoraceae	*Fervidicella*	*Fervidicella metallireducens*
Bacillota	Fictibacillaceae	*Fictibacillus*	*Fictibacillus aquaticus*
Bacillota	Fictibacillaceae	*Fictibacillus*	*Fictibacillus arsenicus*
Bacillota	Fictibacillaceae	*Fictibacillus*	*Fictibacillus barbaricus*
Bacillota	Fictibacillaceae	*Fictibacillus*	*Fictibacillus gelatini*
Bacillota	Fictibacillaceae	*Fictibacillus*	*Fictibacillus halophilus*
Bacillota	Fictibacillaceae	*Fictibacillus*	*Fictibacillus iocasae*
Bacillota	Fictibacillaceae	*Fictibacillus*	*Fictibacillus phosphorivorans*
Bacillota	Fictibacillaceae	*Fictibacillus*	*Fictibacillus rigui*
Bacillota	Planococcaceae	*Filibacter*	*Filibacter limicola*
Bacillota	Oscillospiraceae	*Flavonifractor*	*Flavonifractor plautii*
Bacillota	Streptococcaceae	*Floricoccus*	*Floricoccus penangensis*
Bacillota	Streptococcaceae	*Floricoccus*	*Floricoccus tropicus*
Bacillota	Incertae	*Fodinicola*	*Fodinicola feengrottensis*
Bacillota	Paenibacillaceae	*Fontibacillus*	*Fontibacillus panacisegetis*

Bacillota	Paenibacillaceae	*Fontibacillus*	*Fontibacillus solani*
Bacillota	Caloramatoraceae	*Fonticella*	*Fonticella tunisiensis*
Bacillota	Ruminococcaceae	*Fournierella*	*Fournierella massiliensis*
Bacillota	Bacillaceae	*Fredinandcohnia*	*Fredinandcohnia humi*
Bacillota	Lachnospiraceae	*Frisingicoccus*	*Frisingicoccus caecimuris*
Bacillota	Lactobacillaceae	*Fructilactobacillus*	*Fructilactobacillus florum*
Bacillota	Lactobacillaceae	*Fructilactobacillus*	*Fructilactobacillus fructivorans*
Bacillota	Lactobacillaceae	*Fructilactobacillus*	*Fructilactobacillus ixorae*
Bacillota	Lactobacillaceae	*Fructilactobacillus*	*Fructilactobacillus lindneri*
Bacillota	Lactobacillaceae	*Fructilactobacillus*	*Fructilactobacillus sanfranciscensis*
Bacillota	Lactobacillaceae	*Fructilactobacillus*	*Fructilactobacillus vespulae*
Bacillota	Lactobacillaceae	*Fructobacillus*	*Fructobacillus durionis*
Bacillota	Lactobacillaceae	*Fructobacillus*	*Fructobacillus ficulneus*
Bacillota	Lactobacillaceae	*Fructobacillus*	*Fructobacillus fructosus*
Bacillota	Lactobacillaceae	*Fructobacillus*	*Fructobacillus pseudoficulneus*
Bacillota	Lactobacillaceae	*Fructobacillus*	*Fructobacillus tropaeoli*
Bacillota	Halobacteroidaceae	*Fuchsiella*	*Fuchsiella ferrireducens*
Bacillota	Lactobacillaceae	*Furfurilactobacillus*	*Furfurilactobacillus curtus*
Bacillota	Lactobacillaceae	*Furfurilactobacillus*	*Furfurilactobacillus rossiae*
Bacillota	Lactobacillaceae	*Furfurilactobacillus*	*Furfurilactobacillus siliginis*
Bacillota	Incertae	*Fusibacter*	*Fusibacter fontis*
Bacillota	Incertae	*Fusibacter*	*Fusibacter paucivorans*

Bacillota	Lachnospiraceae	*Fusicatenibacter*	*Fusicatenibacter saccharivorans*
Bacillota	Gemellaceae	*Gemella*	*Gemella bergeri*
Bacillota	Gemellaceae	*Gemella*	*Gemella cuniculi*
Bacillota	Gemellaceae	*Gemella*	*Gemella haemolysans*
Bacillota	Gemellaceae	*Gemella*	*Gemella morbillorum*
Bacillota	Gemellaceae	*Gemella*	*Gemella palaticanis*
Bacillota	Gemellaceae	*Gemella*	*Gemella sanguinis*
Bacillota	Ruminococcaceae	*Gemmiger*	*Gemmiger formicilis*
Bacillota	Anoxybacillaceae	*Geobacillus*	*Geobacillus kaustophilus*
Bacillota	Anoxybacillaceae	*Geobacillus*	*Geobacillus stearothermophilus*
Bacillota	Anoxybacillaceae	*Geobacillus*	*Geobacillus subterraneus*
Bacillota	Thermotaleaceae	*Geosporobacter*	*Geosporobacter subterraneus*
Bacillota	Aerococcaceae	*Globicatella*	*Globicatella sanguinis*
Bacillota	Aerococcaceae	*Globicatella*	*Globicatella sulfidifaciens*
Bacillota	Lachnospiraceae	*Gluceribacter*	*Gluceribacter canis*
Bacillota	Paenibacillaceae	*Gorillibacterium*	*Gorillibacterium massiliense*
Bacillota	Bacillaceae	*Gottfriedia*	*Gottfriedia luciferensis*
Bacillota	Bacillaceae	*Gottfriedia*	*Gottfriedia solisilvae*
Bacillota	Gottschalkiaceae	*Gottschalkia*	*Gottschalkia acidurici*
Bacillota	Gottschalkiaceae	*Gottschalkia*	*Gottschalkia purinilytica*
Bacillota	Amphibacillaceae	*Gracilibacillus*	*Gracilibacillus timonensis*
Bacillota	Amphibacillaceae	*Gracilibacillus*	*Gracilibacillus xinjiangensis*

Bacillota	Syntrophobotulaceae	*Gracilibacter*	*Gracilibacter thermotolerans*
Bacillota	Aerococcaceae	*Granulicatella*	*Granulicatella adiacens*
Bacillota	Aerococcaceae	*Granulicatella*	*Granulicatella balaenopterae*
Bacillota	Aerococcaceae	*Granulicatella*	*Granulicatella elegans*
Bacillota	Alkalibacillaceae	*Halalkalibacillus*	*Halalkalibacillus halophilus*
Bacillota	Halobacillaceae	*Halobacillus*	*Halobacillus andaensis*
Bacillota	Halobacillaceae	*Halobacillus*	*Halobacillus dabanensis*
Bacillota	Halobacillaceae	*Halobacillus*	*Halobacillus faecis*
Bacillota	Halobacillaceae	*Halobacillus*	*Halobacillus halophilus*
Bacillota	Halobacillaceae	*Halobacillus*	*Halobacillus sediminis*
Bacillota	Halobacillaceae	*Halobacillus*	*Halobacillus yeomjeoni*
Bacillota	Clostridiaceae	*Haloimpatiens*	*Haloimpatiens lingqiaonensis*
Bacillota	Amphibacillaceae	*Halolactibacillus*	*Halolactibacillus halophilus*
Bacillota	Amphibacillaceae	*Halolactibacillus*	*Halolactibacillus miurensis*
Bacillota	Haloplasmataceae	*Haloplasma*	*Haloplasma contractile*
Bacillota	Acholeplasmataceae	*Haploplasma*	*Haploplasma axanthum*
Bacillota	Ruminococcaceae	*Harryflintia*	*Harryflintia acetispora*
Bacillota	Clostridiaceae	*Hathewaya*	*Hathewaya histolytica*
Bacillota	Clostridiaceae	*Hathewaya*	*Hathewaya limosa*
Bacillota	Clostridiaceae	*Hathewaya*	*Hathewaya proteolytica*
Bacillota	Heliobacteriaceae	*Heliobacillus*	*Heliobacillus mobilis*
Bacillota	Heliobacteriaceae	*Heliophilum*	*Heliophilum fasciatum*

Bacillota	Heliobacteriaceae	*Heliorestis*	*Heliorestis acidaminivorans*
Bacillota	Heliobacteriaceae	*Heliorestis*	*Heliorestis baculata*
Bacillota	Lachnospiraceae	*Herbinix*	*Herbinix hemicellulosilytica*
Bacillota	Lachnospiraceae	*Herbinix*	*Herbinix luporum*
Bacillota	Lachnospiraceae	*Hespellia*	*Hespellia porcina*
Bacillota	Lachnospiraceae	*Hespellia*	*Hespellia stercorisuis*
Bacillota	Bacillaceae	*Heyndrickxia*	*Heyndrickxia oleronia*
Bacillota	Bacillaceae	*Heyndrickxia*	*Heyndrickxia sporothermodurans*
Bacillota	Erysipelotrichaceae	*Holdemania*	*Holdemania massiliensis*
Bacillota	Lactobacillaceae	*Holzapfelia*	*Holzapfelia floricola*
Bacillota	Eubacteriaceae	*Howardella*	*Howardella ureilytica*
Bacillota	Acetivibrionaceae	*Hungateiclostridium*	*Hungateiclostridium aldrichii*
Bacillota	Acetivibrionaceae	*Hungateiclostridium*	*Hungateiclostridium alkalicellulosi*
Bacillota	Acetivibrionaceae	*Hungateiclostridium*	*Hungateiclostridium cellulolyticum*
Bacillota	Acetivibrionaceae	*Hungateiclostridium*	*Hungateiclostridium clariflavum*
Bacillota	Acetivibrionaceae	*Hungateiclostridium*	*Hungateiclostridium saccincola*
Bacillota	Acetivibrionaceae	*Hungateiclostridium*	*Hungateiclostridium straminisolvens*
Bacillota	Acetivibrionaceae	*Hungateiclostridium*	*Hungateiclostridium thermocellum*
Bacillota	Lachnospiraceae	*Hungatella*	*Hungatella effluvii*
Bacillota	Lachnospiraceae	*Hungatella*	*Hungatella hathewayi*
Bacillota	Lachnospiraceae	*Hungatella*	*Hungatella xylanolytica*
Bacillota	UBA8346	*Hydrogenispora*	*Hydrogenispora ethanolica*

Bacillota	Ruminococcaceae	*Hydrogenoanaerobacterium*	*Hydrogenoanaerobacterium saccharovorans*
Bacillota	Aerococcaceae	*Ignavigranum*	*Ignavigranum ruoffiae*
Bacillota	Incertae	*Ihubacter*	*Ihubacter massiliensis*
Bacillota	Butyricicoccaceae	*Intestinibacillus*	*Intestinibacillus massiliensis*
Bacillota	Peptostreptococcaceae	*Intestinibacter*	*Intestinibacter bartlettii*
Bacillota	Oscillospiraceae	*Intestinimonas*	*Intestinimonas butyriciproducens*
Bacillota	Eubacteriaceae	*Irregularibacter*	*Irregularibacter muris*
Bacillota	Carnobacteriaceae	*Isobaculum*	*Isobaculum melis*
Bacillota	Aerococcaceae	*Jeotgalibaca*	*Jeotgalibaca arthritidis*
Bacillota	Aerococcaceae	*Jeotgalibaca*	*Jeotgalibaca dankookensis*
Bacillota	Aerococcaceae	*Jeotgalibaca*	*Jeotgalibaca porci*
Bacillota	Jeotgalibacillaceae	*Jeotgalibacillus*	*Jeotgalibacillus alimentarius*
Bacillota	Jeotgalibacillaceae	*Jeotgalibacillus*	*Jeotgalibacillus campisalis*
Bacillota	Jeotgalibacillaceae	*Jeotgalibacillus*	*Jeotgalibacillus malaysiensis*
Bacillota	Jeotgalibacillaceae	*Jeotgalibacillus*	*Jeotgalibacillus marinus*
Bacillota	Jeotgalibacillaceae	*Jeotgalibacillus*	*Jeotgalibacillus salarius*
Bacillota	Jeotgalibacillaceae	*Jeotgalibacillus*	*Jeotgalibacillus soli*
Bacillota	Jeotgalibacillaceae	*Jeotgalibacillus*	*Jeotgalibacillus terrae*
Bacillota	Salinicoccaceae	*Jeotgalicoccus*	*Jeotgalicoccus halotolerans*
Bacillota	Salinicoccaceae	*Jeotgalicoccus*	*Jeotgalicoccus huakuii*
Bacillota	Salinicoccaceae	*Jeotgalicoccus*	*Jeotgalicoccus nanhaiensis*

Bacillota	Salinicoccaceae	*Jeotgalicoccus*	*Jeotgalicoccus psychrophilus*
Bacillota	Salinicoccaceae	*Jeotgalicoccus*	*Jeotgalicoccus schoeneichii*
Bacillota	Lachnospiraceae	*Johnsonella*	*Johnsonella ignava*
Bacillota	Erysipelatoclostridiaceae	*Kandleria*	*Kandleria vitulina*
Bacillota	Tepidimicrobiaceae	*Keratinibaculum*	*Keratinibaculum paraultunense*
Bacillota	Lachnospiraceae	*Kineothrix*	*Kineothrix alysoides*
Bacillota	Planococcaceae	*Kurthia*	*Kurthia gibsonii*
Bacillota	Planococcaceae	*Kurthia*	*Kurthia massiliensis*
Bacillota	Planococcaceae	*Kurthia*	*Kurthia populi*
Bacillota	Planococcaceae	*Kurthia*	*Kurthia senegalensis*
Bacillota	Planococcaceae	*Kurthia*	*Kurthia sibirica*
Bacillota	Planococcaceae	*Kurthia*	*Kurthia zopfii*
Bacillota	Lachnospiraceae	*Lachnoanaerobaculum*	*Lachnoanaerobaculum gingivalis*
Bacillota	Lachnospiraceae	*Lachnoclostridium*	*Lachnoclostridium pacaense*
Bacillota	Lachnospiraceae	*Lachnoclostridium*	*Lachnoclostridium phytofermentans*
Bacillota	Lachnospiraceae	*Lachnospira*	*Lachnospira multipara*
Bacillota	Lachnospiraceae	*Lachnotalea*	*Lachnotalea glycerini*
Bacillota	Lachnospiraceae	*Lacrimispora*	*Lacrimispora aerotolerans*
Bacillota	Lachnospiraceae	*Lacrimispora*	*Lacrimispora algidixylanolytica*
Bacillota	Lachnospiraceae	*Lacrimispora*	*Lacrimispora amygdalina*
Bacillota	Lachnospiraceae	*Lacrimispora*	*Lacrimispora indolis*
Bacillota	Lachnospiraceae	*Lacrimispora*	*Lacrimispora saccharolytica*

Bacillota	Lachnospiraceae	*Lacrimispora*	*Lacrimispora sphenoides*
Bacillota	Lactobacillaceae	*Lacticaseibacillus*	*Lacticaseibacillus brantae*
Bacillota	Lactobacillaceae	*Lacticaseibacillus*	*Lacticaseibacillus camelliae*
Bacillota	Lactobacillaceae	*Lacticaseibacillus*	*Lacticaseibacillus casei*
Bacillota	Lactobacillaceae	*Lacticaseibacillus*	*Lacticaseibacillus hulanensis*
Bacillota	Lactobacillaceae	*Lacticaseibacillus*	*Lacticaseibacillus manihotivorans*
Bacillota	Lactobacillaceae	*Lacticaseibacillus*	*Lacticaseibacillus nasuensis*
Bacillota	Lactobacillaceae	*Lacticaseibacillus*	*Lacticaseibacillus pantheris*
Bacillota	Lactobacillaceae	*Lacticaseibacillus*	*Lacticaseibacillus paracasei*
Bacillota	Lactobacillaceae	*Lacticaseibacillus*	*Lacticaseibacillus porcinae*
Bacillota	Lactobacillaceae	*Lacticaseibacillus*	*Lacticaseibacillus rhamnosus*
Bacillota	Lactobacillaceae	*Lacticaseibacillus*	*Lacticaseibacillus saniviri*
Bacillota	Lactobacillaceae	*Lacticaseibacillus*	*Lacticaseibacillus sharpeae*
Bacillota	Lactobacillaceae	*Lacticaseibacillus*	*Lacticaseibacillus songhuajiangensis*
Bacillota	Lactobacillaceae	*Lacticaseibacillus*	*Lacticaseibacillus thailandensis*
Bacillota	Lactobacillaceae	*Lacticaseibacillus*	*Lacticaseibacillus zeae*
Bacillota	Carnobacteriaceae	*Lacticigenium*	*Lacticigenium naphtae*
Bacillota	Carnobacteriaceae	*Lacticigenium*	*Lacticigenium naphthae*
Bacillota	Lactobacillaceae	*Lactiplantibacillus*	*Lactiplantibacillus argentoratensis*
Bacillota	Lactobacillaceae	*Lactiplantibacillus*	*Lactiplantibacillus fabifermentans*
Bacillota	Lactobacillaceae	*Lactiplantibacillus*	*Lactiplantibacillus herbarum*
Bacillota	Lactobacillaceae	*Lactiplantibacillus*	*Lactiplantibacillus mudanjiangensis*

Bacillota	Lactobacillaceae	*Lactiplantibacillus*	*Lactiplantibacillus paraplantarum*
Bacillota	Lactobacillaceae	*Lactiplantibacillus*	*Lactiplantibacillus pentosus*
Bacillota	Lactobacillaceae	*Lactiplantibacillus*	*Lactiplantibacillus plajomi*
Bacillota	Lactobacillaceae	*Lactiplantibacillus*	*Lactiplantibacillus plantarum*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus acetotolerans*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus acidifarinae*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus acidipiscis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus acidophilus*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus agilis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus algidus*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus allii*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus amylolyticus*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus amylophilus*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus animalis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus antri*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus apinorum*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus apodemi*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus aquaticus*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus aviarius*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus backii*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus bifermentans*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus brantae*

Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus cacaonum*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus camelliae*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus capillatus*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus casei*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus caviae*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus coleohominis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus colini*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus composti*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus concavus*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus coryniformis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus crispatus*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus curieae*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus curtus*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus curvatus*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus delbrueckii*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus dextrinicus*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus equi*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus equicursoris*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus equigenerosi*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus fabifermentans*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus faecis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus farciminis*

Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus farraginis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus fermentum*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus floricola*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus fructivorans*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus fuchuensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus furfuricola*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus futsaii*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus gallinarum*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus gasseri*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus gastricus*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus ginsenosidimutans*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus graminis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus hammesii*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus hamsteri*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus harbinensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus hayakitensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus helsingborgensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus helveticus*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus hilgardii*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus hokkaidonensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus hominis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus homohiochii*

Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus iners*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus insicii*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus intestinalis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus iwatensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus ixorae*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus jensenii*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus johnsonii*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus kalixensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus kefiranofaciens*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus kimchiensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus kisonensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus kitasatonis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus kunkeei*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus leichmannii*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus lindneri*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus malefermentans*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus mali*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus manihotivorans*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus mellifer*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus mellis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus melliventris*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus mixtipabuli*

Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus modestisalitolerans*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus mucosae*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus mudanjiangensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus murinus*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus nagelii*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus namurensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus nantensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus nasuensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus nenjiangensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus nodensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus odoratitofui*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus oeni*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus oligofermentans*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus oris*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus oryzae*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus otakiensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus ozensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus panis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus pantheris*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus parabrevis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus parabuchneri*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus paracasei*

Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus paracollinoides*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus parafarraginis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus paralimentarius*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus paraplantarum*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus paucivorans*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus pentosiphilus*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus pentosus*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus plajomi*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus plantarum*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus pobuzihii*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus pontis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus porcinae*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus rapi*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus reuteri*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus rhamnosus*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus rodentium*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus rogosae*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus ruminis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus saerimneri*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus sakei*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus salivarius*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus sanfranciscensis*

Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus saniviri*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus satsumensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus secaliphilus*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus selangorensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus senioris*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus senmaizukei*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus sharpeae*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus shenzhenensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus silagincola*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus siliginis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus similis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus songhuajiangensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus sucicola*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus suebicus*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus sunkii*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus taiwanensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus tucceti*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus ultunensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus uvarum*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus vaccinostercus*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus vaginalis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus versmoldensis*

Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus vespulae*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus vini*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus wasatchensis*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus zeae*
Bacillota	Lactobacillaceae	*Lactobacillus*	*Lactobacillus zymae*
Bacillota	Streptococcaceae	*Lactococcus*	*Lactococcus chungangensis*
Bacillota	Streptococcaceae	*Lactococcus*	*Lactococcus cremoris*
Bacillota	Streptococcaceae	*Lactococcus*	*Lactococcus formosensis*
Bacillota	Streptococcaceae	*Lactococcus*	*Lactococcus fujiensis*
Bacillota	Streptococcaceae	*Lactococcus*	*Lactococcus garvieae*
Bacillota	Streptococcaceae	*Lactococcus*	*Lactococcus hircilactis*
Bacillota	Streptococcaceae	*Lactococcus*	*Lactococcus lactis*
Bacillota	Streptococcaceae	*Lactococcus*	*Lactococcus laudensis*
Bacillota	Streptococcaceae	*Lactococcus*	*Lactococcus nasutitermitis*
Bacillota	Streptococcaceae	*Lactococcus*	*Lactococcus piscium*
Bacillota	Streptococcaceae	*Lactococcus*	*Lactococcus plantarum*
Bacillota	Streptococcaceae	*Lactococcus*	*Lactococcus raffinolactis*
Bacillota	Streptococcaceae	*Lactococcus*	*Lactococcus taiwanensis*
Bacillota	Lachnospiraceae	*Lactonifactor*	*Lactonifactor longoviformis*
Bacillota	Streptococcaceae	*Lactovum*	*Lactovum miscens*
Bacillota	Lactobacillaceae	*Lapidilactobacillus*	*Lapidilactobacillus concavus*
Bacillota	Lactobacillaceae	*Lapidilactobacillus*	*Lapidilactobacillus dextrinicus*

Bacillota	Lactobacillaceae	*Latilactobacillus*	*Latilactobacillus curvatus*
Bacillota	Lactobacillaceae	*Latilactobacillus*	*Latilactobacillus fuchuensis*
Bacillota	Lactobacillaceae	*Latilactobacillus*	*Latilactobacillus graminis*
Bacillota	Lactobacillaceae	*Latilactobacillus*	*Latilactobacillus sakei*
Bacillota	Oscillospiraceae	*Lawsonibacter*	*Lawsonibacter asaccharolyticus*
Bacillota	Bacillaceae	*Lederbergia*	*Lederbergia galactosidilyticus*
Bacillota	Bacillaceae	*Lederbergia*	*Lederbergia lentus*
Bacillota	Bacillaceae	*Lederbergia*	*Lederbergia panacisoli*
Bacillota	Bacillaceae	*Lederbergia*	*Lederbergia ruris*
Bacillota	Bacillaceae	*Lederbergia*	*Lederbergia wuyishanensis*
Bacillota	Amphibacillaceae	*Lentibacillus*	*Lentibacillus alimentarius*
Bacillota	Amphibacillaceae	*Lentibacillus*	*Lentibacillus salicampi*
Bacillota	Amphibacillaceae	*Lentibacillus*	*Lentibacillus salis*
Bacillota	Lactobacillaceae	*Lentilactobacillus*	*Lentilactobacillus buchneri*
Bacillota	Lactobacillaceae	*Lentilactobacillus*	*Lentilactobacillus curieae*
Bacillota	Lactobacillaceae	*Lentilactobacillus*	*Lentilactobacillus diolivorans*
Bacillota	Lactobacillaceae	*Lentilactobacillus*	*Lentilactobacillus farraginis*
Bacillota	Lactobacillaceae	*Lentilactobacillus*	*Lentilactobacillus hilgardii*
Bacillota	Lactobacillaceae	*Lentilactobacillus*	*Lentilactobacillus kefiri*
Bacillota	Lactobacillaceae	*Lentilactobacillus*	*Lentilactobacillus kisonensis*
Bacillota	Lactobacillaceae	*Lentilactobacillus*	*Lentilactobacillus otakiensis*
Bacillota	Lactobacillaceae	*Lentilactobacillus*	*Lentilactobacillus parabuchneri*

Bacillota	Lactobacillaceae	*Lentilactobacillus*	*Lentilactobacillus parafarraginis*
Bacillota	Lactobacillaceae	*Lentilactobacillus*	*Lentilactobacillus parakefiri*
Bacillota	Lactobacillaceae	*Lentilactobacillus*	*Lentilactobacillus rapi*
Bacillota	Lactobacillaceae	*Lentilactobacillus*	*Lentilactobacillus senioris*
Bacillota	Lactobacillaceae	*Lentilactobacillus*	*Lentilactobacillus sunkii*
Bacillota	Lactobacillaceae	*Leuconostoc*	*Leuconostoc carnosum*
Bacillota	Lactobacillaceae	*Leuconostoc*	*Leuconostoc citreum*
Bacillota	Lactobacillaceae	*Leuconostoc*	*Leuconostoc fallax*
Bacillota	Lactobacillaceae	*Leuconostoc*	*Leuconostoc gelidum*
Bacillota	Lactobacillaceae	*Leuconostoc*	*Leuconostoc holzapfelii*
Bacillota	Lactobacillaceae	*Leuconostoc*	*Leuconostoc inhae*
Bacillota	Lactobacillaceae	*Leuconostoc*	*Leuconostoc kimchii*
Bacillota	Lactobacillaceae	*Leuconostoc*	*Leuconostoc lactis*
Bacillota	Lactobacillaceae	*Leuconostoc*	*Leuconostoc mesenteroides*
Bacillota	Lactobacillaceae	*Leuconostoc*	*Leuconostoc miyukkimchii*
Bacillota	Lactobacillaceae	*Leuconostoc*	*Leuconostoc palmae*
Bacillota	Lactobacillaceae	*Leuconostoc*	*Leuconostoc pseudomesenteroides*
Bacillota	Lactobacillaceae	*Leuconostoc*	*Leuconostoc rapi*
Bacillota	Lactobacillaceae	*Leuconostoc*	*Leuconostoc suionicum*
Bacillota	Lactobacillaceae	*Levilactobacillus*	*Levilactobacillus acidifarinae*
Bacillota	Lactobacillaceae	*Levilactobacillus*	*Levilactobacillus brevis*
Bacillota	Lactobacillaceae	*Levilactobacillus*	*Levilactobacillus cerevisiae*

Bacillota	Lactobacillaceae	*Levilactobacillus*	*Levilactobacillus hammesii*
Bacillota	Lactobacillaceae	*Levilactobacillus*	*Levilactobacillus koreensis*
Bacillota	Lactobacillaceae	*Levilactobacillus*	*Levilactobacillus namurensis*
Bacillota	Lactobacillaceae	*Levilactobacillus*	*Levilactobacillus parabrevis*
Bacillota	Lactobacillaceae	*Levilactobacillus*	*Levilactobacillus paucivorans*
Bacillota	Lactobacillaceae	*Levilactobacillus*	*Levilactobacillus senmaizukei*
Bacillota	Lactobacillaceae	*Levilactobacillus*	*Levilactobacillus spicheri*
Bacillota	Lactobacillaceae	*Levilactobacillus*	*Levilactobacillus zymae*
Bacillota	Lactobacillaceae	*Ligilactobacillus*	*Ligilactobacillus acidipiscis*
Bacillota	Lactobacillaceae	*Ligilactobacillus*	*Ligilactobacillus agilis*
Bacillota	Lactobacillaceae	*Ligilactobacillus*	*Ligilactobacillus animalis*
Bacillota	Lactobacillaceae	*Ligilactobacillus*	*Ligilactobacillus apodemi*
Bacillota	Lactobacillaceae	*Ligilactobacillus*	*Ligilactobacillus araffinosus*
Bacillota	Lactobacillaceae	*Ligilactobacillus*	*Ligilactobacillus aviarius*
Bacillota	Lactobacillaceae	*Ligilactobacillus*	*Ligilactobacillus ceti*
Bacillota	Lactobacillaceae	*Ligilactobacillus*	*Ligilactobacillus equi*
Bacillota	Lactobacillaceae	*Ligilactobacillus*	*Ligilactobacillus faecis*
Bacillota	Lactobacillaceae	*Ligilactobacillus*	*Ligilactobacillus hayakitensis*
Bacillota	Lactobacillaceae	*Ligilactobacillus*	*Ligilactobacillus murinus*
Bacillota	Lactobacillaceae	*Ligilactobacillus*	*Ligilactobacillus pobuzihii*
Bacillota	Lactobacillaceae	*Ligilactobacillus*	*Ligilactobacillus ruminis*
Bacillota	Lactobacillaceae	*Ligilactobacillus*	*Ligilactobacillus saerimneri*

Bacillota	Lactobacillaceae	*Ligilactobacillus*	*Ligilactobacillus salivarius*
Bacillota	Lactobacillaceae	*Limosilactobacillus*	*Limosilactobacillus alvi*
Bacillota	Lactobacillaceae	*Limosilactobacillus*	*Limosilactobacillus caviae*
Bacillota	Lactobacillaceae	*Limosilactobacillus*	*Limosilactobacillus coleohominis*
Bacillota	Lactobacillaceae	*Limosilactobacillus*	*Limosilactobacillus equigenerosi*
Bacillota	Lactobacillaceae	*Limosilactobacillus*	*Limosilactobacillus fermentum*
Bacillota	Lactobacillaceae	*Limosilactobacillus*	*Limosilactobacillus frumenti*
Bacillota	Lactobacillaceae	*Limosilactobacillus*	*Limosilactobacillus gastricus*
Bacillota	Lactobacillaceae	*Limosilactobacillus*	*Limosilactobacillus mucosae*
Bacillota	Lactobacillaceae	*Limosilactobacillus*	*Limosilactobacillus pontis*
Bacillota	Lactobacillaceae	*Limosilactobacillus*	*Limosilactobacillus reuteri*
Bacillota	Lactobacillaceae	*Limosilactobacillus*	*Limosilactobacillus secaliphilus*
Bacillota	Lactobacillaceae	*Liquorilactobacillus*	*Liquorilactobacillus aquaticus*
Bacillota	Lactobacillaceae	*Liquorilactobacillus*	*Liquorilactobacillus cacaonum*
Bacillota	Lactobacillaceae	*Liquorilactobacillus*	*Liquorilactobacillus capillatus*
Bacillota	Lactobacillaceae	*Liquorilactobacillus*	*Liquorilactobacillus ghanensis*
Bacillota	Lactobacillaceae	*Liquorilactobacillus*	*Liquorilactobacillus hordei*
Bacillota	Lactobacillaceae	*Liquorilactobacillus*	*Liquorilactobacillus mali*
Bacillota	Lactobacillaceae	*Liquorilactobacillus*	*Liquorilactobacillus nagelii*
Bacillota	Lactobacillaceae	*Liquorilactobacillus*	*Liquorilactobacillus oeni*
Bacillota	Lactobacillaceae	*Liquorilactobacillus*	*Liquorilactobacillus satsumensis*
Bacillota	Lactobacillaceae	*Liquorilactobacillus*	*Liquorilactobacillus sucicola*

Bacillota	Lactobacillaceae	*Liquorilactobacillus*	*Liquorilactobacillus uvarum*
Bacillota	Lactobacillaceae	*Liquorilactobacillus*	*Liquorilactobacillus vini*
Bacillota	Listeriaceae	*Listeria*	*Listeria aquatica*
Bacillota	Listeriaceae	*Listeria*	*Listeria fleischmannii*
Bacillota	Listeriaceae	*Listeria*	*Listeria floridensis*
Bacillota	Listeriaceae	*Listeria*	*Listeria grayi*
Bacillota	Listeriaceae	*Listeria*	*Listeria innocua*
Bacillota	Listeriaceae	*Listeria*	*Listeria ivanovii*
Bacillota	Listeriaceae	*Listeria*	*Listeria monocytogenes*
Bacillota	Listeriaceae	*Listeria*	*Listeria riparia*
Bacillota	Listeriaceae	*Listeria*	*Listeria rocourtiae*
Bacillota	Listeriaceae	*Listeria*	*Listeria seeligeri*
Bacillota	Listeriaceae	*Listeria*	*Listeria weihenstephanensis*
Bacillota	Listeriaceae	*Listeria*	*Listeria welshimeri*
Bacillota	Bacillaceae	*Litchfieldia*	*Litchfieldia salsus*
Bacillota	Bacillaceae	*Litoribacterium*	*Litoribacterium kuwaitense*
Bacillota	Lactobacillaceae	*Loigolactobacillus*	*Loigolactobacillus backii*
Bacillota	Lactobacillaceae	*Loigolactobacillus*	*Loigolactobacillus bifermentans*
Bacillota	Lactobacillaceae	*Loigolactobacillus*	*Loigolactobacillus coryniformis*
Bacillota	Lactobacillaceae	*Loigolactobacillus*	*Loigolactobacillus iwatensis*
Bacillota	Lactobacillaceae	*Loigolactobacillus*	*Loigolactobacillus rennini*
Bacillota	Bacillaceae	*Lottiidibacillus*	*Lottiidibacillus patelloidae*

Bacillota	Lutisporaceae	*Lutispora*	*Lutispora thermophila*
Bacillota	Planococcaceae	*Lysinibacillus*	*Lysinibacillus alkaliphilus*
Bacillota	Planococcaceae	*Lysinibacillus*	*Lysinibacillus boronitolerans*
Bacillota	Planococcaceae	*Lysinibacillus*	*Lysinibacillus endophyticus*
Bacillota	Planococcaceae	*Lysinibacillus*	*Lysinibacillus fusiformis*
Bacillota	Planococcaceae	*Lysinibacillus*	*Lysinibacillus halotolerans*
Bacillota	Planococcaceae	*Lysinibacillus*	*Lysinibacillus macroides*
Bacillota	Planococcaceae	*Lysinibacillus*	*Lysinibacillus odysseyi*
Bacillota	Planococcaceae	*Lysinibacillus*	*Lysinibacillus pakistanensis*
Bacillota	Planococcaceae	*Lysinibacillus*	*Lysinibacillus parviboronicapiens*
Bacillota	Planococcaceae	*Lysinibacillus*	*Lysinibacillus sphaericus*
Bacillota	Planococcaceae	*Lysinibacillus*	*Lysinibacillus tabacifolii*
Bacillota	Staphylococcaceae	*Macrococcus*	*Macrococcus bohemicus*
Bacillota	Staphylococcaceae	*Macrococcus*	*Macrococcus bovicus*
Bacillota	Staphylococcaceae	*Macrococcus*	*Macrococcus brunensis*
Bacillota	Staphylococcaceae	*Macrococcus*	*Macrococcus canis*
Bacillota	Staphylococcaceae	*Macrococcus*	*Macrococcus carouselicus*
Bacillota	Staphylococcaceae	*Macrococcus*	*Macrococcus caseolyticus*
Bacillota	Staphylococcaceae	*Macrococcus*	*Macrococcus equipercicus*
Bacillota	Staphylococcaceae	*Macrococcus*	*Macrococcus goetzii*
Bacillota	Staphylococcaceae	*Macrococcus*	*Macrococcus goetzii;Macrococcus*
Bacillota	Staphylococcaceae	*Macrococcus*	*Macrococcus hajekii*

Bacillota	Staphylococcaceae	*Macrococcus*	*Macrococcus lamae*
Bacillota	Mahellaceae	*Mahella*	*Mahella australiensis*
Bacillota	Staphylococcaceae	*Mammaliicoccus*	*Mammaliicoccus lentus*
Bacillota	Staphylococcaceae	*Mammaliicoccus*	*Mammaliicoccus sciuri*
Bacillota	Staphylococcaceae	*Mammaliicoccus*	*Mammaliicoccus stepanovicii*
Bacillota	Staphylococcaceae	*Mammaliicoccus*	*Mammaliicoccus vitulinus*
Bacillota	Bacillaceae	*Margalitia*	*Margalitia camelliae*
Bacillota	Bacillaceae	*Margalitia*	*Margalitia shackletonii*
Bacillota	Carnobacteriaceae	*Marinilactibacillus*	*Marinilactibacillus piezotolerans*
Bacillota	Carnobacteriaceae	*Marinilactibacillus*	*Marinilactibacillus psychrotolerans*
Bacillota	Thermotaleaceae	*Marinisporobacter*	*Marinisporobacter balticus*
Bacillota	Massilibacteriaceae	*Massilibacterium*	*Massilibacterium senegalense*
Bacillota	Lachnospiraceae	*Mediterraneibacter*	*Mediterraneibacter glycyrrhizinilyticus*
Bacillota	Megasphaeraceae	*Megasphaera*	*Megasphaera indica*
Bacillota	Megasphaeraceae	*Megasphaera*	*Megasphaera massiliensis*
Bacillota	Enterococcaceae	*Melissococcus*	*Melissococcus plutonius*
Bacillota	Bacillaceae	*Mesobacillus*	*Mesobacillus foraminis*
Bacillota	Bacillaceae	*Mesobacillus*	*Mesobacillus jeotgali*
Bacillota	Bacillaceae	*Mesobacillus*	*Mesobacillus maritimus*
Bacillota	Bacillaceae	*Mesobacillus*	*Mesobacillus persicus*
Bacillota	Bacillaceae	*Mesobacillus*	*Mesobacillus rigiliprofundi*
Bacillota	Bacillaceae	*Mesobacillus*	*Mesobacillus stamsii*

Bacillota	Bacillaceae	*Mesobacillus*	*Mesobacillus subterraneus*
Bacillota	Bacillaceae	*Metabacillus*	*Metabacillus fastidiosus*
Bacillota	Bacillaceae	*Metabacillus*	*Metabacillus galliciensis*
Bacillota	Bacillaceae	*Metabacillus*	*Metabacillus halosaccharovorans*
Bacillota	Bacillaceae	*Metabacillus*	*Metabacillus herbersteinensis*
Bacillota	Bacillaceae	*Metabacillus*	*Metabacillus indicus*
Bacillota	Bacillaceae	*Metabacillus*	*Metabacillus litoralis*
Bacillota	Bacillaceae	*Metabacillus*	*Metabacillus malikii*
Bacillota	Bacillaceae	*Metabacillus*	*Metabacillus niabensis*
Bacillota	Planococcaceae	*Metasolibacillus*	*Metasolibacillus fluoroglycofenilyticus*
Bacillota	Lachnospiraceae	*Mobilisporobacter*	*Mobilisporobacter senegalensis*
Bacillota	Lachnospiraceae	*Mobilitalea*	*Mobilitalea sibirica*
Bacillota	Anaerovoracaceae	*Mogibacterium*	*Mogibacterium neglectum*
Bacillota	Anaerovoracaceae	*Mogibacterium*	*Mogibacterium timidum*
Bacillota	Monoglobaceae	*Monoglobus*	*Monoglobus pectinilyticus*
Bacillota	Moorellaceae	*Moorella*	*Moorella humiferrea*
Bacillota	Moorellaceae	*Moorella*	*Moorella perchloratireducens*
Bacillota	Moorellaceae	*Moorella*	*Moorella thermoacetica*
Bacillota	Clostridiaceae	*Mordavella*	*Mordavella massiliensis*
Bacillota	Lachnospiraceae	*Murimonas*	*Murimonas intestini*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma alvi*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma capricolum*

Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma falconis*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma fastidiosum*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma faucium*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma gateae*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma genitalium*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma gypis*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma hominis*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma hyorhinis*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma iowae*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma lagogenitalium*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma microti*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma moatsii*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma mobile*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma molare*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma muris*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma mycoides*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma neophronis*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma orale*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma penetrans*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma pirum*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma sualvi*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma subdolum*

Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma testudinis*
Bacillota	Mycoplasmataceae	*Mycoplasma*	*Mycoplasma tullyi*
Bacillota	Metamycoplasmataceae	*Mycoplasmopsis*	*Mycoplasmopsis bovis*
Bacillota	Metamycoplasmataceae	*Mycoplasmopsis*	*Mycoplasmopsis edwardii*
Bacillota	Metamycoplasmataceae	*Mycoplasmopsis*	*Mycoplasmopsis gallinarum*
Bacillota	Metamycoplasmataceae	*Mycoplasmopsis*	*Mycoplasmopsis lipofaciens*
Bacillota	Metamycoplasmataceae	*Mycoplasmopsis*	*Mycoplasmopsis lipophila*
Bacillota	Metamycoplasmataceae	*Mycoplasmopsis*	*Mycoplasmopsis meleagridis*
Bacillota	Metamycoplasmataceae	*Mycoplasmopsis*	*Mycoplasmopsis pullorum*
Bacillota	Natranaerobiaceae	*Natranaerobaculum*	*Natranaerobaculum magadiense*
Bacillota	DSM-24629	*Natranaerovirga*	*Natranaerovirga hydrolytica*
Bacillota	DSM-24629	*Natranaerovirga*	*Natranaerovirga pectinivora*
Bacillota	Natronincolaceae	*Natronincola*	*Natronincola ferrireducens*
Bacillota	Natronincolaceae	*Natronincola*	*Natronincola peptidivorans*
Bacillota	Ruminococcaceae	*Negativibacillus*	*Negativibacillus massiliensis*
Bacillota	Oscillospiraceae	*Neglecta*	*Neglecta timonensis*
Bacillota	Bacillaceae	*Neobacillus*	*Neobacillus bataviensis*
Bacillota	Bacillaceae	*Neobacillus*	*Neobacillus circulans*
Bacillota	Bacillaceae	*Neobacillus*	*Neobacillus cucumis*
Bacillota	Bacillaceae	*Neobacillus*	*Neobacillus drentensis*
Bacillota	Bacillaceae	*Neobacillus*	*Neobacillus fumarioli*
Bacillota	Bacillaceae	*Neobacillus*	*Neobacillus jeddahensis*

Bacillota	Bacillaceae	*Neobacillus*	*Neobacillus mesonae*
Bacillota	Bacillaceae	*Neobacillus*	*Neobacillus niacini*
Bacillota	Bacillaceae	*Neobacillus*	*Neobacillus novalis*
Bacillota	Bacillaceae	*Neobacillus*	*Neobacillus thermocopriae*
Bacillota	Bacillaceae	*Niallia*	*Niallia circulans*
Bacillota	Bacillaceae	*Niallia*	*Niallia endozanthoxylicus*
Bacillota	Bacillaceae	*Niallia*	*Niallia nealsonii*
Bacillota	Incertae	*Nordella*	*Nordella oligomobilis*
Bacillota	Salinicoccaceae	*Nosocomiicoccus*	*Nosocomiicoccus ampullae*
Bacillota	Salinicoccaceae	*Nosocomiicoccus*	*Nosocomiicoccus massiliensis*
Bacillota	Clostridiaceae	*Oceanirhabdus*	*Oceanirhabdus sediminicola*
Bacillota	Amphibacillaceae	*Oceanobacillus*	*Oceanobacillus arenosus*
Bacillota	Amphibacillaceae	*Oceanobacillus*	*Oceanobacillus bengalensis*
Bacillota	Amphibacillaceae	*Oceanobacillus*	*Oceanobacillus caeni*
Bacillota	Amphibacillaceae	*Oceanobacillus*	*Oceanobacillus halophilum*
Bacillota	Amphibacillaceae	*Oceanobacillus*	*Oceanobacillus iheyensis*
Bacillota	Amphibacillaceae	*Oceanobacillus*	*Oceanobacillus indicireducens*
Bacillota	Amphibacillaceae	*Oceanobacillus*	*Oceanobacillus jeddahense*
Bacillota	Amphibacillaceae	*Oceanobacillus*	*Oceanobacillus kimchii*
Bacillota	Amphibacillaceae	*Oceanobacillus*	*Oceanobacillus limi*
Bacillota	Amphibacillaceae	*Oceanobacillus*	*Oceanobacillus massiliensis*
Bacillota	Amphibacillaceae	*Oceanobacillus*	*Oceanobacillus oncorhynchi*

Bacillota	Amphibacillaceae	*Oceanobacillus*	*Oceanobacillus picturae*
Bacillota	Amphibacillaceae	*Oceanobacillus*	*Oceanobacillus polygoni*
Bacillota	Amphibacillaceae	*Oceanobacillus*	*Oceanobacillus rekensis*
Bacillota	Amphibacillaceae	*Oceanobacillus*	*Oceanobacillus senegalensis*
Bacillota	Amphibacillaceae	*Oceanobacillus*	*Oceanobacillus sojae*
Bacillota	Amphibacillaceae	*Oceanobacillus*	*Oceanobacillus timonensis*
Bacillota	Lactobacillaceae	*Oenococcus*	*Oenococcus oeni*
Bacillota	Amphibacillaceae	*Ornithinibacillus*	*Ornithinibacillus bavariensis*
Bacillota	Amphibacillaceae	*Ornithinibacillus*	*Ornithinibacillus californiensis*
Bacillota	Amphibacillaceae	*Ornithinibacillus*	*Ornithinibacillus contaminans*
Bacillota	Amphibacillaceae	*Ornithinibacillus*	*Ornithinibacillus halophilus*
Bacillota	Amphibacillaceae	*Ornithinibacillus*	*Ornithinibacillus heyuanensis*
Bacillota	Amphibacillaceae	*Ornithinibacillus*	*Ornithinibacillus salinisoli*
Bacillota	Amphibacillaceae	*Ornithinibacillus*	*Ornithinibacillus scapharcae*
Bacillota	Oscillospiraceae	*Oscillibacter*	*Oscillibacter ruminantium*
Bacillota	Oscillospiraceae	*Oscillibacter*	*Oscillibacter valericigenes*
Bacillota	Paenibacillaceae	*Oxalophagus*	*Oxalophagus oxalicus*
Bacillota	Oxobacteraceae	*Oxobacter*	*Oxobacter pfennigii*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus aceris*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus aceti*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus agaridevorans*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus albus*

Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus alginolyticus*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus algorifonticola*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus alvei*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus amylolyticus*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus anaericanus*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus antarcticus*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus antibioticophila*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus aquistagni*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus arcticus*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus assamensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus azoreducens*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus azotifigens*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus barcinonensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus borealis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus bovis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus camelliae*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus campinasensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus castaneae*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus catalpae*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus cellulosilyticus*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus chibensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus chinjuensis*

Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus chitinolyticus*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus contaminans*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus cookii*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus daejeonensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus dakarensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus dendritiformis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus gansuensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus gelatinilyticus*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus ginsengihumi*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus glacialis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus glucanolyticus*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus glycanilyticus*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus gorillae*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus granivorans*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus guangzhouensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus harenae*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus helianthi*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus herberti*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus hodogayensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus hordei*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus humicus*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus ihumii*

Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus illinoisensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus jamilae*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus kobensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus koleovorans*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus lactis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus lacus*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus larvae*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus lautus*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus liaoningensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus lupini*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus lutimineralis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus lutrae*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus macerans*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus marchantiophytorum*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus marinisediminis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus massiliensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus medicaginis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus mucilaginosus*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus nasutitermitis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus nebraskensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus odorifer*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus oralis*

Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus oryzae*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus pabuli*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus panaciterrae*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus peoriae*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus pinihumi*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus pinisoli*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus polymyxa*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus profundus*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus prosopidis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus provencensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus psychroresistens*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus qingshengii*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus quercus*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus relictisesami*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus rhizoryzae*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus rigui*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus sabinae*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus sanguinis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus sediminis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus selenii*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus selenitireducens*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus senegalensis*

Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus shunpengii*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus silagei*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus silvae*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus sinopodophylli*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus solani*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus soli*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus stellifer*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus taichungensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus taiwanensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus telluris*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus thailandensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus thermoaerophilus*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus thermophilus*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus tianmuensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus timonensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus tritici*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus tundrae*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus turicensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus typhae*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus uliginis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus urinalis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus validus*

Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus wooponensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus wulumuqiensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus xinjiangensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus xylanilyticus*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus yonginensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus yunnanensis*
Bacillota	Paenibacillaceae	*Paenibacillus*	*Paenibacillus zeae*
Bacillota	Peptostreptococcaceae	*Paeniclostridium*	*Paeniclostridium ghonii*
Bacillota	Peptostreptococcaceae	*Paeniclostridium*	*Paeniclostridium sordellii*
Bacillota	Planococcaceae	*Paenisporosarcina*	*Paenisporosarcina indica*
Bacillota	Planococcaceae	*Paenisporosarcina*	*Paenisporosarcina macmurdoensis*
Bacillota	Planococcaceae	*Paenisporosarcina*	*Paenisporosarcina quisquiliarum*
Bacillota	Oscillospiraceae	*Paludicola*	*Paludicola psychrotolerans*
Bacillota	Thermoactinomycetaceae	*Paludifilum*	*Paludifilum halophilum*
Bacillota	Oscillospiraceae	*Papillibacter*	*Papillibacter cinnamivorans*
Bacillota	Peptostreptococcaceae	*Paraclostridium*	*Paraclostridium benzoelyticum*
Bacillota	Peptostreptococcaceae	*Paraclostridium*	*Paraclostridium bifermentans*
Bacillota	Anoxybacillaceae	*Parageobacillus*	*Parageobacillus thermantarcticus*
Bacillota	Lachnospiraceae	*Parasporobacterium*	*Parasporobacterium paucivorans*
Bacillota	Helcococcaceae	*Parvimonas*	*Parvimonas micra*
Bacillota	Lactobacillaceae	*Paucilactobacillus*	*Paucilactobacillus hokkaidonensis*
Bacillota	Lactobacillaceae	*Paucilactobacillus*	*Paucilactobacillus nenjiangensis*

Bacillota	Lactobacillaceae	*Paucilactobacillus*	*Paucilactobacillus oligofermentans*
Bacillota	Lactobacillaceae	*Paucilactobacillus*	*Paucilactobacillus suebicus*
Bacillota	Lactobacillaceae	*Paucilactobacillus*	*Paucilactobacillus vaccinostercus*
Bacillota	Lactobacillaceae	*Paucilactobacillus*	*Paucilactobacillus wasatchensis*
Bacillota	Amphibacillaceae	*Paucisalibacillus*	*Paucisalibacillus globulus*
Bacillota	Selenomonadaceae	*Pectinatus*	*Pectinatus haikarae*
Bacillota	Selenomonadaceae	*Pectinatus*	*Pectinatus sottacetonis*
Bacillota	Lactobacillaceae	*Pediococcus*	*Pediococcus acidilactici*
Bacillota	Lactobacillaceae	*Pediococcus*	*Pediococcus argentinicus*
Bacillota	Lactobacillaceae	*Pediococcus*	*Pediococcus cellicola*
Bacillota	Lactobacillaceae	*Pediococcus*	*Pediococcus claussenii*
Bacillota	Lactobacillaceae	*Pediococcus*	*Pediococcus damnosus*
Bacillota	Lactobacillaceae	*Pediococcus*	*Pediococcus ethanolidurans*
Bacillota	Lactobacillaceae	*Pediococcus*	*Pediococcus inopinatus*
Bacillota	Lactobacillaceae	*Pediococcus*	*Pediococcus parvulus*
Bacillota	Lactobacillaceae	*Pediococcus*	*Pediococcus pentosaceus*
Bacillota	Lactobacillaceae	*Pediococcus*	*Pediococcus siamensis*
Bacillota	Lactobacillaceae	*Pediococcus*	*Pediococcus stilesii*
Bacillota	Sporomusaceae	*Pelorhabdus*	*Pelorhabdus rhamnosifermentans*
Bacillota	Pelosinaceae	*Pelosinus*	*Pelosinus defluvii*
Bacillota	Pelosinaceae	*Pelosinus*	*Pelosinus propionicus*
Bacillota	Pelotomaculaceae	*Pelotomaculum*	*Pelotomaculum isophthalicicum*

Bacillota	Pelotomaculaceae	*Pelotomaculum*	*Pelotomaculum propionicicum*
Bacillota	Pelotomaculaceae	*Pelotomaculum*	*Pelotomaculum thermopropionicum*
Bacillota	Peptostreptococcaceae	*Peptacetobacter*	*Peptacetobacter hiranonis*
Bacillota	Peptoclostridiaceae	*Peptoclostridium*	*Peptoclostridium acidaminophilum*
Bacillota	Peptoclostridiaceae	*Peptoclostridium*	*Peptoclostridium litorale*
Bacillota	Peptoniphilaceae	*Peptoniphilus*	*Peptoniphilus asaccharolyticus*
Bacillota	Peptoniphilaceae	*Peptoniphilus*	*Peptoniphilus grossensis*
Bacillota	Peptoniphilaceae	*Peptoniphilus*	*Peptoniphilus koenoeneniae*
Bacillota	Peptoniphilaceae	*Peptoniphilus*	*Peptoniphilus methioninivorax*
Bacillota	Peptoniphilaceae	*Peptoniphilus*	*Peptoniphilus stercorisuis*
Bacillota	Peptostreptococcaceae	*Peptostreptococcus*	*Peptostreptococcus anaerobius*
Bacillota	Peptostreptococcaceae	*Peptostreptococcus*	*Peptostreptococcus canis*
Bacillota	Peptostreptococcaceae	*Peptostreptococcus*	*Peptostreptococcus russellii*
Bacillota	Peptostreptococcaceae	*Peptostreptococcus*	*Peptostreptococcus stomatis*
Bacillota	Bacillaceae	*Peribacillus*	*Peribacillus asahii*
Bacillota	Bacillaceae	*Peribacillus*	*Peribacillus deserti*
Bacillota	Bacillaceae	*Peribacillus*	*Peribacillus huizhouensis*
Bacillota	Bacillaceae	*Peribacillus*	*Peribacillus kribbensis*
Bacillota	Bacillaceae	*Peribacillus*	*Peribacillus loiseleuriae*
Bacillota	Bacillaceae	*Peribacillus*	*Peribacillus muralis*
Bacillota	Bacillaceae	*Peribacillus*	*Peribacillus psychrosaccharolyticus*
Bacillota	Bacillaceae	*Peribacillus*	*Peribacillus simplex*

Bacillota	Vallitaleaceae	*Petrocella*	*Petrocella atlantisensis*
Bacillota	Acidaminococcaceae	*Phascolarctobacterium*	*Phascolarctobacterium faecium*
Bacillota	Acidaminococcaceae	*Phascolarctobacterium*	*Phascolarctobacterium succinatutens*
Bacillota	Ruminococcaceae	*Phocea*	*Phocea massiliensis*
Bacillota	Streptococcaceae	*Pilibacter*	*Pilibacter termitis*
Bacillota	Alkalibacillaceae	*Piscibacillus*	*Piscibacillus salipiscarius*
Bacillota	Carnobacteriaceae	*Pisciglobus*	*Pisciglobus halotolerans*
Bacillota	Thermoactinomycetaceae	*Planifilum*	*Planifilum yunnanense*
Bacillota	Planococcaceae	*Planococcus*	*Planococcus chinensis*
Bacillota	Planococcaceae	*Planococcus*	*Planococcus dechangensis*
Bacillota	Planococcaceae	*Planococcus*	*Planococcus halocryophilus*
Bacillota	Planococcaceae	*Planococcus*	*Planococcus kocurii*
Bacillota	Planococcaceae	*Planococcus*	*Planococcus maitriensis*
Bacillota	Planococcaceae	*Planococcus*	*Planococcus maritimus*
Bacillota	Planococcaceae	*Planococcus*	*Planococcus plakortidis*
Bacillota	Planococcaceae	*Planococcus*	*Planococcus rifietoensis*
Bacillota	Planococcaceae	*Planococcus*	*Planococcus salinus*
Bacillota	Planococcaceae	*Planomicrobium*	*Planomicrobium chinense*
Bacillota	Planococcaceae	*Planomicrobium*	*Planomicrobium mcmeekinii*
Bacillota	Planococcaceae	*Planomicrobium*	*Planomicrobium okeanokoites*
Bacillota	Halobacillaceae	*Pontibacillus*	*Pontibacillus halophilus*
Bacillota	Halobacillaceae	*Pontibacillus*	*Pontibacillus litoralis*

Bacillota	Bacillaceae	*Pradoshia*	*Pradoshia eiseniae*
Bacillota	Bacillaceae	*Priestia*	*Priestia abyssalis*
Bacillota	Bacillaceae	*Priestia*	*Priestia aryabhattai*
Bacillota	Bacillaceae	*Priestia*	*Priestia endophytica*
Bacillota	Bacillaceae	*Priestia*	*Priestia filamentosa*
Bacillota	Bacillaceae	*Priestia*	*Priestia flexa*
Bacillota	Bacillaceae	*Priestia*	*Priestia koreensis*
Bacillota	Bacillaceae	*Priestia*	*Priestia megaterium*
Bacillota	Bacillaceae	*Priestia*	*Priestia paraflexa*
Bacillota	Selenomonadaceae	*Propionispira*	*Propionispira arcuata*
Bacillota	Selenomonadaceae	*Propionispira*	*Propionispira paucivorans*
Bacillota	Selenomonadaceae	*Propionispira*	*Propionispira raffinosivorans*
Bacillota	Propionisporaceae	*Propionispora*	*Propionispora hippei*
Bacillota	Propionisporaceae	*Propionispora*	*Propionispora vibrioides*
Bacillota	Proteiniboraceae	*Proteiniborus*	*Proteiniborus ethanoligenes*
Bacillota	Proteiniboraceae	*Proteiniborus*	*Proteiniborus indolifex*
Bacillota	Clostridiaceae	*Proteiniclasticum*	*Proteiniclasticum ruminis*
Bacillota	Proteinivoraceae	*Proteinivorax*	*Proteinivorax tanatarense*
Bacillota	Acetivibrionaceae	*Pseudobacteroides*	*Pseudobacteroides cellulosolvens*
Bacillota	Lachnospiraceae	*Pseudobutyrivibrio*	*Pseudobutyrivibrio ruminis*
Bacillota	Acetivibrionaceae	*Pseudoclostridium*	*Pseudoclostridium thermosuccinogenes*
Bacillota	Oscillospiraceae	*Pseudoflavonifractor*	*Pseudoflavonifractor capillosus*

Bacillota	Oscillospiraceae	*Pseudoflavonifractor*	*Pseudoflavonifractor phocaeensis*
Bacillota	Incertae	*Pseudoscillatoria*	*Pseudoscillatoria coralii*
Bacillota	Planococcaceae	*Psychrobacillus*	*Psychrobacillus lasiicapitis*
Bacillota	Sporomusaceae	*Psychrosinus*	*Psychrosinus fermentans*
Bacillota	Sporolactobacillaceae	*Pullulanibacillus*	*Pullulanibacillus camelliae*
Bacillota	Sporolactobacillaceae	*Pullulanibacillus*	*Pullulanibacillus naganoensis*
Bacillota	Sporolactobacillaceae	*Pullulanibacillus*	*Pullulanibacillus pueri*
Bacillota	Sporolactobacillaceae	*Pullulanibacillus*	*Pullulanibacillus uraniitolerans*
Bacillota	Domibacillaceae	*Quasibacillus*	*Quasibacillus thermotolerans*
Bacillota	Eubacteriaceae	*Rhabdanaerobium*	*Rhabdanaerobium thermarum*
Bacillota	Bacillaceae	*Robertmurraya*	*Robertmurraya beringensis*
Bacillota	Bacillaceae	*Robertmurraya*	*Robertmurraya crescens*
Bacillota	Bacillaceae	*Robertmurraya*	*Robertmurraya korlensis*
Bacillota	Bacillaceae	*Robertmurraya*	*Robertmurraya kyonggiensis*
Bacillota	Bacillaceae	*Robertmurraya*	*Robertmurraya massiliosenegalensis*
Bacillota	Bacillaceae	*Robertmurraya*	*Robertmurraya siralis*
Bacillota	Lachnospiraceae	*Robinsoniella*	*Robinsoniella peoriensis*
Bacillota	Peptostreptococcaceae	*Romboutsia*	*Romboutsia ilealis*
Bacillota	Peptostreptococcaceae	*Romboutsia*	*Romboutsia lituseburensis*
Bacillota	Peptostreptococcaceae	*Romboutsia*	*Romboutsia sedimentorum*
Bacillota	Peptostreptococcaceae	*Romboutsia*	*Romboutsia timonensis*
Bacillota	Lachnospiraceae	*Roseburia*	*Roseburia faecis*

Bacillota	Lachnospiraceae	*Roseburia*	*Roseburia hominis*
Bacillota	Lachnospiraceae	*Roseburia*	*Roseburia intestinalis*
Bacillota	Lachnospiraceae	*Roseburia*	*Roseburia inulinivorans*
Bacillota	Bacillaceae	*Rossellomorea*	*Rossellomorea aquimaris*
Bacillota	Bacillaceae	*Rossellomorea*	*Rossellomorea marisflavi*
Bacillota	Bacillaceae	*Rossellomorea*	*Rossellomorea oryzaecorticis*
Bacillota	Bacillaceae	*Rossellomorea*	*Rossellomorea vietnamensis*
Bacillota	Acetivibrionaceae	*Ruminiclostridium*	*Ruminiclostridium cellobioparum*
Bacillota	Acetivibrionaceae	*Ruminiclostridium*	*Ruminiclostridium cellulolyticum*
Bacillota	Acetivibrionaceae	*Ruminiclostridium*	*Ruminiclostridium hungatei*
Bacillota	Acetivibrionaceae	*Ruminiclostridium*	*Ruminiclostridium josui*
Bacillota	Acetivibrionaceae	*Ruminiclostridium*	*Ruminiclostridium papyrosolvens*
Bacillota	Acetivibrionaceae	*Ruminiclostridium*	*Ruminiclostridium sufflavum*
Bacillota	Oscillospiraceae	*Ruminococcoides*	*Ruminococcoides bili*
Bacillota	Ruminococcaceae	*Ruminococcus*	*Ruminococcus albus*
Bacillota	Ruminococcaceae	*Ruminococcus*	*Ruminococcus bromii*
Bacillota	Ruminococcaceae	*Ruminococcus*	*Ruminococcus callidus*
Bacillota	Ruminococcaceae	*Ruminococcus*	*Ruminococcus champanellensis*
Bacillota	Ruminococcaceae	*Ruminococcus*	*Ruminococcus faecis*
Bacillota	Ruminococcaceae	*Ruminococcus*	*Ruminococcus flavefaciens*
Bacillota	Ruminococcaceae	*Ruminococcus*	*Ruminococcus gauvreauii*
Bacillota	Ruminococcaceae	*Ruminococcus*	*Ruminococcus gnavus*

Bacillota	Ruminococcaceae	*Ruminococcus*	*Ruminococcus torques*
Bacillota	Planococcaceae	*Rummeliibacillus*	*Rummeliibacillus pycnus*
Bacillota	Planococcaceae	*Rummeliibacillus*	*Rummeliibacillus stabekisii*
Bacillota	Planococcaceae	*Rummeliibacillus*	*Rummeliibacillus suwonensis*
Bacillota	Ruminococcaceae	*Ruthenibacterium*	*Ruthenibacterium lactatiformans*
Bacillota	Bacillaceae	*Saccharococcus*	*Saccharococcus thermophilus*
Bacillota	Saccharofermentanaceae	*Saccharofermentans*	*Saccharofermentans acetigenes*
Bacillota	Clostridiaceae	*Salimesophilobacter*	*Salimesophilobacter vulgaris*
Bacillota	Alkalibacillaceae	*Salinibacillus*	*Salinibacillus aidingensis*
Bacillota	Alkalibacillaceae	*Salinibacillus*	*Salinibacillus kushneri*
Bacillota	Alkalibacillaceae	*Salinibacillus*	*Salinibacillus xinjiangensis*
Bacillota	Salinicoccaceae	*Salinicoccus*	*Salinicoccus albus*
Bacillota	Salinicoccaceae	*Salinicoccus*	*Salinicoccus alkaliphilus*
Bacillota	Salinicoccaceae	*Salinicoccus*	*Salinicoccus halodurans*
Bacillota	Salinicoccaceae	*Salinicoccus*	*Salinicoccus hispanicus*
Bacillota	Salinicoccaceae	*Salinicoccus*	*Salinicoccus kekensis*
Bacillota	Salinicoccaceae	*Salinicoccus*	*Salinicoccus kunmingensis*
Bacillota	Salinicoccaceae	*Salinicoccus*	*Salinicoccus roseus*
Bacillota	Salinicoccaceae	*Salinicoccus*	*Salinicoccus salitudinis*
Bacillota	Salinicoccaceae	*Salinicoccus*	*Salinicoccus salsiraiae*
Bacillota	Salinicoccaceae	*Salinicoccus*	*Salinicoccus sediminis*
Bacillota	Salinicoccaceae	*Salinicoccus*	*Salinicoccus sesuvii*

Bacillota	Salinicoccaceae	*Salinicoccus*	*Salinicoccus siamensis*
Bacillota	Alkalibacillaceae	*Salirhabdus*	*Salirhabdus euzebyi*
Bacillota	Alkalibacillaceae	*Salirhabdus*	*Salirhabdus salicampi*
Bacillota	Clostridiaceae	*Sarcina*	*Sarcina maxima*
Bacillota	Clostridiaceae	*Sarcina*	*Sarcina ventriculi*
Bacillota	Bacillaceae	*Schinkia*	*Schinkia azotoformans*
Bacillota	Bacillaceae	*Schinkia*	*Schinkia oryziterrae*
Bacillota	Lactobacillaceae	*Schleiferilactobacillus*	*Schleiferilactobacillus harbinensis*
Bacillota	Lactobacillaceae	*Schleiferilactobacillus*	*Schleiferilactobacillus kimchicus*
Bacillota	Lactobacillaceae	*Schleiferilactobacillus*	*Schleiferilactobacillus odoratitofui*
Bacillota	Lactobacillaceae	*Schleiferilactobacillus*	*Schleiferilactobacillus oryzae*
Bacillota	Lactobacillaceae	*Schleiferilactobacillus*	*Schleiferilactobacillus perolens*
Bacillota	Lactobacillaceae	*Schleiferilactobacillus*	*Schleiferilactobacillus shenzhenensis*
Bacillota	Lactobacillaceae	*Schleiferilactobacillus*	*Schleiferilactobacillus silagei*
Bacillota	Lactobacillaceae	*Schleiferilactobacillus*	*Schleiferilactobacillus similis*
Bacillota	Sporolactobacillaceae	*Scopulibacillus*	*Scopulibacillus daqui*
Bacillota	Lactobacillaceae	*Secundilactobacillus*	*Secundilactobacillus collinoides*
Bacillota	Lactobacillaceae	*Secundilactobacillus*	*Secundilactobacillus malefermentans*
Bacillota	Lactobacillaceae	*Secundilactobacillus*	*Secundilactobacillus mixtipabuli*
Bacillota	Lactobacillaceae	*Secundilactobacillus*	*Secundilactobacillus paracollinoides*
Bacillota	Lactobacillaceae	*Secundilactobacillus*	*Secundilactobacillus pentosiphilus*
Bacillota	Lactobacillaceae	*Secundilactobacillus*	*Secundilactobacillus silagincola*

Bacillota	Sedimentibacteraceae	*Sedimentibacter*	*Sedimentibacter hydroxybenzoicus*
Bacillota	Selenomonadaceae	*Selenomonas*	*Selenomonas lacticifex*
Bacillota	Clostridiaceae	*Senegalia*	*Senegalia massiliensis*
Bacillota	Natronincolaceae	*Serpentinicella*	*Serpentinicella alkaliphila*
Bacillota	Lachnospiraceae	*Shuttleworthia*	*Shuttleworthia satelles*
Bacillota	Bacillaceae	*Siminovitchia*	*Siminovitchia composti*
Bacillota	Bacillaceae	*Siminovitchia*	*Siminovitchia fortis*
Bacillota	Bacillaceae	*Siminovitchia*	*Siminovitchia terrae*
Bacillota	Incertae	*Sinanaerobacter*	*Sinanaerobacter chloroacetimidivorans*
Bacillota	Tissierellaceae	*Soehngenia*	*Soehngenia saccharolytica*
Bacillota	Planococcaceae	*Solibacillus*	*Solibacillus isronensis*
Bacillota	Planococcaceae	*Solibacillus*	*Solibacillus kalamii*
Bacillota	Oscillospiraceae	*Solibaculum*	*Solibaculum mannosilyticum*
Bacillota	Mycoplasmataceae	*Spiroplasma*	*Spiroplasma atrichopogonis*
Bacillota	Mycoplasmataceae	*Spiroplasma*	*Spiroplasma insolitum*
Bacillota	Mycoplasmataceae	*Spiroplasma*	*Spiroplasma lineolae*
Bacillota	Mycoplasmataceae	*Spiroplasma*	*Spiroplasma melliferum*
Bacillota	Mycoplasmataceae	*Spiroplasma*	*Spiroplasma mirum*
Bacillota	Mycoplasmataceae	*Spiroplasma*	*Spiroplasma montanense*
Bacillota	Mycoplasmataceae	*Spiroplasma*	*Spiroplasma phoeniceum*
Bacillota	Mycoplasmataceae	*Spiroplasma*	*Spiroplasma syrphidicola*
Bacillota	Peptostreptococcaceae	*Sporacetigenium*	*Sporacetigenium mesophilum*

Bacillota	Oscillospiraceae	*Sporobacter*	*Sporobacter termitidis*
Bacillota	Lachnospiraceae	*Sporobacterium*	*Sporobacterium olearium*
Bacillota	Sporolactobacillaceae	*Sporolactobacillus*	*Sporolactobacillus kofuensis*
Bacillota	Sporolactobacillaceae	*Sporolactobacillus*	*Sporolactobacillus laevolacticus*
Bacillota	Sporolactobacillaceae	*Sporolactobacillus*	*Sporolactobacillus nakayamae*
Bacillota	Sporolactobacillaceae	*Sporolactobacillus*	*Sporolactobacillus pectinivorans*
Bacillota	Sporolactobacillaceae	*Sporolactobacillus*	*Sporolactobacillus terrae*
Bacillota	Sporomusaceae	*Sporomusa*	*Sporomusa acidovorans*
Bacillota	Sporomusaceae	*Sporomusa*	*Sporomusa aerivorans*
Bacillota	Sporomusaceae	*Sporomusa*	*Sporomusa malonica*
Bacillota	Sporomusaceae	*Sporomusa*	*Sporomusa ovata*
Bacillota	Sporomusaceae	*Sporomusa*	*Sporomusa paucivorans*
Bacillota	Sporomusaceae	*Sporomusa*	*Sporomusa rhizae*
Bacillota	Sporomusaceae	*Sporomusa*	*Sporomusa silvacetica*
Bacillota	Sporomusaceae	*Sporomusa*	*Sporomusa sphaeroides*
Bacillota	Thermohalobacteraceae	*Sporosalibacterium*	*Sporosalibacterium tautonense*
Bacillota	Planococcaceae	*Sporosarcina*	*Sporosarcina aquimarina*
Bacillota	Planococcaceae	*Sporosarcina*	*Sporosarcina koreensis*
Bacillota	Planococcaceae	*Sporosarcina*	*Sporosarcina pasteurii*
Bacillota	Planococcaceae	*Sporosarcina*	*Sporosarcina psychrophila*
Bacillota	Planococcaceae	*Sporosarcina*	*Sporosarcina saromensis*
Bacillota	Planococcaceae	*Sporosarcina*	*Sporosarcina ureae*

Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus agnetis*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus arlettae*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus aureus*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus auricularis*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus capitis*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus caprae*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus carnosus*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus chromogenes*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus coagulans*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus cohnii*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus condimenti*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus croceilyticus*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus delphini*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus devriesei*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus edaphicus*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus epidermidis*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus equorum*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus felis*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus gallinarum*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus haemolyticus*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus hominis*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus hyicus*

Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus kloosii*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus lentus*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus lugdunensis*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus lutrae*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus massiliensis*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus microti*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus muscae*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus nepalensis*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus pasteuri*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus petrasii*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus pettenkoferi*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus piscifermentans*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus pragensis*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus pseudintermedius*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus rostri*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus saccharolyticus*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus saprophyticus*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus schleiferi*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus sciuri*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus simiae*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus simulans*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus stepanovicii*

Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus succinus*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus ureilyticus*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus warneri*
Bacillota	Staphylococcaceae	*Staphylococcus*	*Staphylococcus xylosus*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus acidominimus*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus agalactiae*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus alactolyticus*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus anginosus*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus australis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus azizii*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus caballi*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus cameli*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus canis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus caprae*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus castoreus*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus chosunense*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus constellatus*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus criceti*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus cristatus*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus cuniculi*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus danieliae*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus dentapri*

Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus dentasini*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus dentiloxodontae*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus dentirousetti*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus devriesei*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus didelphis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus downei*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus dysgalactiae*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus entericus*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus equi*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus equinus*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus ferus*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus fryi*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus gallinaceus*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus gallolyticus*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus gordonii*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus gwangjuense*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus halichoeri*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus halotolerans*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus henryi*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus himalayensis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus hongkongensis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus hyointestinalis*

Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus hyovaginalis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus ictaluri*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus infantarius*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus infantis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus iniae*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus intermedius*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus koreensis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus lactarius*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus loxodontisalivarius*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus lutetiensis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus macacae*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus macedonicus*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus marimammalium*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus marmotae*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus massiliensis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus merionis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus minor*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus mitis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus moroccensis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus mutans*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus oralis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus oricebi*

Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus orisasini*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus orisratti*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus orisuis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus ovis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus ovuberis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus panodentis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus pantholopis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus parasanguinis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus parauberis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus pasteurianus*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus periodonticum*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus pharyngis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus phocae*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus pluranimalium*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus plurextorum*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus pneumoniae*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus porci*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus porcinus*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus porcorum*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus pseudopneumoniae*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus pseudoporcinus*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus pyogenes*

Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus rifensis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus rubneri*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus ruminantium*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus rupicaprae*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus salivarius*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus saliviloxodontae*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus sanguinis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus sinensis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus sobrinus*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus suis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus tangierensis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus thermophilus*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus thoraltensis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus troglodytae*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus troglodytidis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus uberis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus urinalis*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus ursoris*
Bacillota	Streptococcaceae	*Streptococcus*	*Streptococcus vestibularis*
Bacillota	Aerococcaceae	*Suicoccus*	*Suicoccus acidiformans*
Bacillota	Bacillaceae	*Sutcliffiella*	*Sutcliffiella cohnii*
Bacillota	Bacillaceae	*Sutcliffiella*	*Sutcliffiella horikoshii*

Bacillota	Bacillaceae	*Sutcliffiella*	*Sutcliffiella zhanjiangensis*
Bacillota	Bacillaceae	*Swionibacillus*	*Swionibacillus sediminis*
Bacillota	Thermacetogeniaceae	*Syntrophaceticus*	*Syntrophaceticus schinkii*
Bacillota	Syntrophobotulaceae	*Syntrophobotulus*	*Syntrophobotulus glycolicus*
Bacillota	Lachnospiraceae	*Syntrophococcus*	*Syntrophococcus sucromutans*
Bacillota	Syntrophomonadaceae	*Syntrophomonas*	*Syntrophomonas cellicola*
Bacillota	Syntrophomonadaceae	*Syntrophomonas*	*Syntrophomonas palmitatica*
Bacillota	Syntrophomonadaceae	*Syntrophomonas*	*Syntrophomonas wolfei*
Bacillota	Alkalibacillaceae	*Tenuibacillus*	*Tenuibacillus halotolerans*
Bacillota	Alkalibacillaceae	*Tenuibacillus*	*Tenuibacillus multivorans*
Bacillota	Peptostreptococcaceae	*Tepidibacter*	*Tepidibacter formicigenes*
Bacillota	Peptostreptococcaceae	*Tepidibacter*	*Tepidibacter mesophilus*
Bacillota	Peptostreptococcaceae	*Tepidibacter*	*Tepidibacter thalassicus*
Bacillota	Oscillospiraceae	*Tepidibaculum*	*Tepidibaculum saccharolyticum*
Bacillota	Amphibacillaceae	*Terribacillus*	*Terribacillus aidingensis*
Bacillota	Amphibacillaceae	*Terribacillus*	*Terribacillus halophilus*
Bacillota	Amphibacillaceae	*Terribacillus*	*Terribacillus saccharophilus*
Bacillota	Sporolactobacillaceae	*Terrilactibacillus*	*Terrilactibacillus laevilacticus*
Bacillota	Peptostreptococcaceae	*Terrisporobacter*	*Terrisporobacter glycolicus*
Bacillota	Peptostreptococcaceae	*Terrisporobacter*	*Terrisporobacter mayombei*
Bacillota	Peptostreptococcaceae	*Terrisporobacter*	*Terrisporobacter petrolearius*
Bacillota	Enterococcaceae	*Tetragenococcus*	*Tetragenococcus halophilus*

Bacillota	Enterococcaceae	*Tetragenococcus*	*Tetragenococcus koreensis*
Bacillota	Enterococcaceae	*Tetragenococcus*	*Tetragenococcus muriaticus*
Bacillota	Enterococcaceae	*Tetragenococcus*	*Tetragenococcus osmophilus*
Bacillota	Enterococcaceae	*Tetragenococcus*	*Tetragenococcus solitarius*
Bacillota	Thermacetogeniaceae	*Thermacetogenium*	*Thermacetogenium phaeum*
Bacillota	Thermincolaceae	*Thermincola*	*Thermincola carboxydiphila*
Bacillota	Thermoactinomycetaceae	*Thermoactinomyces*	*Thermoactinomyces daqus*
Bacillota	Thermoactinomycetaceae	*Thermoactinomyces*	*Thermoactinomyces khenchelensis*
Bacillota	Thermoanaerobacteraceae	*Thermoanaerobacter*	*Thermoanaerobacter brockii*
Bacillota	Thermoanaerobacteraceae	*Thermoanaerobacterium*	*Thermoanaerobacterium aciditolerans*
Bacillota	Thermoanaerobacteraceae	*Thermoanaerobacterium*	*Thermoanaerobacterium calidifontis*
Bacillota	Thermoanaerobacteraceae	*Thermoanaerobacterium*	*Thermoanaerobacterium xylanolyticum*
Bacillota	Paenibacillaceae	*Thermobacillus*	*Thermobacillus composti*
Bacillota	Paenibacillaceae	*Thermobacillus*	*Thermobacillus xylanilyticus*
Bacillota	DSM-8532	*Thermoclostridium*	*Thermoclostridium caenicola*
Bacillota	DSM-8532	*Thermoclostridium*	*Thermoclostridium stercorarium*
Bacillota	Thermolithobacteraceae	*Thermolithobacter*	*Thermolithobacter carboxydivorans*
Bacillota	Thermosinaceae	*Thermosinus*	*Thermosinus carboxydivorans*
Bacillota	Thermotaleaceae	*Thermotalea*	*Thermotalea metallivorans*
Bacillota	Tindalliaceae	*Tindallia*	*Tindallia texcoconensis*
Bacillota	Aerococcaceae	*Trichococcus*	*Trichococcus alkaliphilus*
Bacillota	Aerococcaceae	*Trichococcus*	*Trichococcus collinsii*

Bacillota	Aerococcaceae	*Trichococcus*	*Trichococcus flocculiformis*
Bacillota	Aerococcaceae	*Trichococcus*	*Trichococcus ilyis*
Bacillota	Aerococcaceae	*Trichococcus*	*Trichococcus paludicola*
Bacillota	Aerococcaceae	*Trichococcus*	*Trichococcus palustris*
Bacillota	Aerococcaceae	*Trichococcus*	*Trichococcus pasteurii*
Bacillota	Aerococcaceae	*Trichococcus*	*Trichococcus patagoniensis*
Bacillota	Aerococcaceae	*Trichococcus*	*Trichococcus shcherbakoviae*
Bacillota	Tumebacillaceae	*Tumebacillus*	*Tumebacillus algifaecis*
Bacillota	Tumebacillaceae	*Tumebacillus*	*Tumebacillus flagellatus*
Bacillota	Tumebacillaceae	*Tumebacillus*	*Tumebacillus ginsengisoli*
Bacillota	Tumebacillaceae	*Tumebacillus*	*Tumebacillus lipolyticus*
Bacillota	Tumebacillaceae	*Tumebacillus*	*Tumebacillus permanentifrigoris*
Bacillota	Tumebacillaceae	*Tumebacillus*	*Tumebacillus soli*
Bacillota	Turicibacteraceae	*Turicibacter*	*Turicibacter sanguinis*
Bacillota	Lachnospiraceae	*Tyzzerella*	*Tyzzerella nexilis*
Bacillota	Mycoplasmoidaceae	*Ureaplasma*	*Ureaplasma canigenitalium*
Bacillota	Mycoplasmoidaceae	*Ureaplasma*	*Ureaplasma diversum*
Bacillota	Mycoplasmoidaceae	*Ureaplasma*	*Ureaplasma felinum*
Bacillota	Mycoplasmoidaceae	*Ureaplasma*	*Ureaplasma gallorale*
Bacillota	Mycoplasmoidaceae	*Ureaplasma*	*Ureaplasma parvum*
Bacillota	Mycoplasmoidaceae	*Ureaplasma*	*Ureaplasma urealyticum*
Bacillota	Planococcaceae	*Ureibacillus*	*Ureibacillus chungkukjangi*

Bacillota	Planococcaceae	*Ureibacillus*	*Ureibacillus composti*
Bacillota	Planococcaceae	*Ureibacillus*	*Ureibacillus manganicus*
Bacillota	Planococcaceae	*Ureibacillus*	*Ureibacillus thermophilus*
Bacillota	Planococcaceae	*Ureibacillus*	*Ureibacillus thermosphaericus*
Bacillota	Tissierellaceae	*Urmitella*	*Urmitella timonensis*
Bacillota	Vagococcaceae	*Vagococcus*	*Vagococcus acidifermentans*
Bacillota	Vagococcaceae	*Vagococcus*	*Vagococcus carniphilus*
Bacillota	Vagococcaceae	*Vagococcus*	*Vagococcus entomophilus*
Bacillota	Vagococcaceae	*Vagococcus*	*Vagococcus fessus*
Bacillota	Vagococcaceae	*Vagococcus*	*Vagococcus fluvialis*
Bacillota	Vagococcaceae	*Vagococcus*	*Vagococcus humatus*
Bacillota	Vagococcaceae	*Vagococcus*	*Vagococcus lutrae*
Bacillota	Vagococcaceae	*Vagococcus*	*Vagococcus martis*
Bacillota	Vagococcaceae	*Vagococcus*	*Vagococcus penaei*
Bacillota	Vagococcaceae	*Vagococcus*	*Vagococcus salmoninarum*
Bacillota	Vagococcaceae	*Vagococcus*	*Vagococcus teuberi*
Bacillota	Vallitaleaceae	*Vallitalea*	*Vallitalea guaymasensis*
Bacillota	Vallitaleaceae	*Vallitalea*	*Vallitalea pronyensis*
Bacillota	Lachnospiraceae	*Variimorphobacter*	*Variimorphobacter saccharofermentans*
Bacillota	Veillonellaceae	*Veillonella*	*Veillonella atypica*
Bacillota	Veillonellaceae	*Veillonella*	*Veillonella caviae*
Bacillota	Veillonellaceae	*Veillonella*	*Veillonella criceti*

Bacillota	Veillonellaceae	*Veillonella*	*Veillonella denticariosi*
Bacillota	Veillonellaceae	*Veillonella*	*Veillonella dispar*
Bacillota	Veillonellaceae	*Veillonella*	*Veillonella infantium*
Bacillota	Veillonellaceae	*Veillonella*	*Veillonella magna*
Bacillota	Veillonellaceae	*Veillonella*	*Veillonella parvula*
Bacillota	Veillonellaceae	*Veillonella*	*Veillonella ratti*
Bacillota	Veillonellaceae	*Veillonella*	*Veillonella tobetsuensis*
Bacillota	Amphibacillaceae	*Virgibacillus*	*Virgibacillus campisalis*
Bacillota	Amphibacillaceae	*Virgibacillus*	*Virgibacillus dokdonensis*
Bacillota	Amphibacillaceae	*Virgibacillus*	*Virgibacillus halodenitrificans*
Bacillota	Amphibacillaceae	*Virgibacillus*	*Virgibacillus halophilus*
Bacillota	Amphibacillaceae	*Virgibacillus*	*Virgibacillus kekensis*
Bacillota	Amphibacillaceae	*Virgibacillus*	*Virgibacillus litoralis*
Bacillota	Amphibacillaceae	*Virgibacillus*	*Virgibacillus marismortui*
Bacillota	Amphibacillaceae	*Virgibacillus*	*Virgibacillus massiliensis*
Bacillota	Amphibacillaceae	*Virgibacillus*	*Virgibacillus necropolis*
Bacillota	Amphibacillaceae	*Virgibacillus*	*Virgibacillus olivae*
Bacillota	Amphibacillaceae	*Virgibacillus*	*Virgibacillus pantothenticus*
Bacillota	Amphibacillaceae	*Virgibacillus*	*Virgibacillus proomii*
Bacillota	Amphibacillaceae	*Virgibacillus*	*Virgibacillus soli*
Bacillota	Planococcaceae	*Viridibacillus*	*Viridibacillus arenosi*
Bacillota	Planococcaceae	*Viridibacillus*	*Viridibacillus arvi*

Bacillota	Lactobacillaceae	*Weissella*	*Weissella beninensis*
Bacillota	Lactobacillaceae	*Weissella*	*Weissella bombi*
Bacillota	Lactobacillaceae	*Weissella*	*Weissella ceti*
Bacillota	Lactobacillaceae	*Weissella*	*Weissella cibaria*
Bacillota	Lactobacillaceae	*Weissella*	*Weissella confusa*
Bacillota	Lactobacillaceae	*Weissella*	*Weissella cryptocerci*
Bacillota	Lactobacillaceae	*Weissella*	*Weissella diestrammenae*
Bacillota	Lactobacillaceae	*Weissella*	*Weissella fabalis*
Bacillota	Lactobacillaceae	*Weissella*	*Weissella fabaria*
Bacillota	Lactobacillaceae	*Weissella*	*Weissella ghanensis*
Bacillota	Lactobacillaceae	*Weissella*	*Weissella halotolerans*
Bacillota	Lactobacillaceae	*Weissella*	*Weissella hellenica*
Bacillota	Lactobacillaceae	*Weissella*	*Weissella jogaejeotgali*
Bacillota	Lactobacillaceae	*Weissella*	*Weissella kandleri*
Bacillota	Lactobacillaceae	*Weissella*	*Weissella koreensis*
Bacillota	Lactobacillaceae	*Weissella*	*Weissella minor*
Bacillota	Lactobacillaceae	*Weissella*	*Weissella oryzae*
Bacillota	Lactobacillaceae	*Weissella*	*Weissella paramesenteroides*
Bacillota	Lactobacillaceae	*Weissella*	*Weissella soli*
Bacillota	Lactobacillaceae	*Weissella*	*Weissella thailandensis*
Bacillota	Lactobacillaceae	*Weissella*	*Weissella uvarum*
Bacillota	Lactobacillaceae	*Weissella*	*Weissella viridescens*

Bacillota	Bacillaceae	*Weizmannia*	*Weizmannia ginsengihum*
Bacillota	Clostridiaceae	*Wukongibacter*	*Wukongibacter baidiensis*
Bacillota	Paenibacillaceae	*Xylanibacillus*	*Xylanibacillus composti*
Bacillota	Clostridiaceae	*Youngiibacter*	*Youngiibacter fragilis*
Bacillota	Clostridiaceae	*Youngiibacter*	*Youngiibacter multivorans*
Bacteroidota	Rikenellaceae	*Acetobacteroides*	*Acetobacteroides hydrogenigenes*
Bacteroidota	Rikenellaceae	*Alistipes*	*Alistipes finegoldii*
Bacteroidota	Rikenellaceae	*Alistipes*	*Alistipes ihumii*
Bacteroidota	Rikenellaceae	*Alistipes*	*Alistipes indistinctus*
Bacteroidota	Rikenellaceae	*Alistipes*	*Alistipes putredinis*
Bacteroidota	Rikenellaceae	*Alistipes*	*Alistipes shahii*
Bacteroidota	Rikenellaceae	*Alistipes*	*Alistipes timonensis*
Bacteroidota	Rikenellaceae	*Ammoniphilus*	*Ammoniphilus oxalaticus*
Bacteroidota	Rikenellaceae	*Ammoniphilus*	*Ammoniphilus oxalivorans*
Bacteroidota	Rikenellaceae	*Anaerocella*	*Anaerocella delicata*
Bacteroidota	Marinilabiliaceae	*Anaerophaga*	*Anaerophaga thermohalophila*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides acidifaciens*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides caecimuris*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides cellulosilyticus*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides coprophilus*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides eggerthii*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides faecichinchillae*

Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides faecis*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides finegoldii*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides fragilis*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides graminisolvens*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides intestinalis*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides luti*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides nordii*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides oleiciplenus*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides pectinophilus*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides reticulotermitis*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides rodentium*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides salyersiae*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides stercorirosoris*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides thetaiotaomicron*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides uniformis*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides xylanisolvens*
Bacteroidota	Bacteroidaceae	*Bacteroides*	*Bacteroides xylanolyticus*
Bacteroidota	Barnesiellaceae	*Barnesiella*	*Barnesiella viscericola*
Bacteroidota	Flavobacteriaceae	*Bizionia*	*Bizionia hallyeonensis*
Bacteroidota	Marinifilaceae	*Butyricimonas*	*Butyricimonas paravirosa*
Bacteroidota	Marinifilaceae	*Butyricimonas*	*Butyricimonas synergistica*
Bacteroidota	Marinifilaceae	*Butyricimonas*	*Butyricimonas virosa*

Bacteroidota	Weeksellaceae	*Chryseobacterium*	*Chryseobacterium joostei*
Bacteroidota	Weeksellaceae	*Chryseobacterium*	*Chryseobacterium montanum*
Bacteroidota	Weeksellaceae	*Chryseobacterium*	*Chryseobacterium shigense*
Bacteroidota	Odoribacteraceae	*Culturomica*	*Culturomica massiliensis*
Bacteroidota	Muribaculaceae	*Duncaniella*	*Duncaniella freteri*
Bacteroidota	Dysgonomonadaceae	*Dysgonomonas*	*Dysgonomonas alginatilytica*
Bacteroidota	Dysgonomonadaceae	*Dysgonomonas*	*Dysgonomonas capnocytophagoides*
Bacteroidota	Dysgonomonadaceae	*Dysgonomonas*	*Dysgonomonas gadei*
Bacteroidota	Dysgonomonadaceae	*Dysgonomonas*	*Dysgonomonas macrotermitis*
Bacteroidota	Dysgonomonadaceae	*Dysgonomonas*	*Dysgonomonas massiliensis*
Bacteroidota	Dysgonomonadaceae	*Dysgonomonas*	*Dysgonomonas mossii*
Bacteroidota	Dysgonomonadaceae	*Dysgonomonas*	*Dysgonomonas oryzarvi*
Bacteroidota	Weeksellaceae	*Elizabethkingia*	*Elizabethkingia anophelis*
Bacteroidota	Chitinophagaceae	*Flavisolibacter*	*Flavisolibacter metallilatus*
Bacteroidota	Chitinophagaceae	*Flavitalea*	*Flavitalea flava*
Bacteroidota	Flavobacteriaceae	*Flavobacterium*	*Flavobacterium acidificum*
Bacteroidota	Marinilabiliaceae	*Geofilum*	*Geofilum rhodophaeum*
Bacteroidota	Marinilabiliaceae	*Geofilum*	*Geofilum rubicundum*
Bacteroidota	Lentimicrobiaceae	*Lentimicrobium*	*Lentimicrobium saccharophilum*
Bacteroidota	Salinibacteraceae	*Longimonas*	*Longimonas halophila*
Bacteroidota	Porphyromonadaceae	*Macellibacteroides*	*Macellibacteroides fermentans*
Bacteroidota	Prolixibacteraceae	*Mangrovibacterium*	*Mangrovibacterium marinum*

Bacteroidota	Prolixibacteraceae	*Maribellus*	*Maribellus luteus*
Bacteroidota	Rikenellaceae	*Millionella*	*Millionella massiliensis*
Bacteroidota	Sphingobacteriaceae	*Mucilaginibacter*	*Mucilaginibacter craterilacus*
Bacteroidota	Sphingobacteriaceae	*Mucilaginibacter*	*Mucilaginibacter yixingensis*
Bacteroidota	Rikenellaceae	*Mucinivorans*	*Mucinivorans hirudinis*
Bacteroidota	Marinifilaceae	*Odoribacter*	*Odoribacter laneus*
Bacteroidota	Marinifilaceae	*Odoribacter*	*Odoribacter splanchnicus*
Bacteroidota	Sphingobacteriaceae	*Olivibacter*	*Olivibacter oleidegradans*
Bacteroidota	Paludibacteraceae	*Paludibacter*	*Paludibacter jiangxiensis*
Bacteroidota	Paludibacteraceae	*Paludibacter*	*Paludibacter propionicigenes*
Bacteroidota	Tannerellaceae	*Parabacteroides*	*Parabacteroides chinchillae*
Bacteroidota	Tannerellaceae	*Parabacteroides*	*Parabacteroides chongii*
Bacteroidota	Tannerellaceae	*Parabacteroides*	*Parabacteroides faecis*
Bacteroidota	Tannerellaceae	*Parabacteroides*	*Parabacteroides goldsteinii*
Bacteroidota	Tannerellaceae	*Parabacteroides*	*Parabacteroides gordonii*
Bacteroidota	Tannerellaceae	*Parabacteroides*	*Parabacteroides johnsonii*
Bacteroidota	Tannerellaceae	*Parabacteroides*	*Parabacteroides merdae*
Bacteroidota	Bacteroidaceae	*Paraprevotella*	*Paraprevotella clara*
Bacteroidota	Sphingobacteriaceae	*Pedobacter*	*Pedobacter agrisoli*
Bacteroidota	Bacteroidaceae	*Phocaeicola*	*Phocaeicola coprophilus*
Bacteroidota	Bacteroidaceae	*Phocaeicola*	*Phocaeicola paurosaccharolyticus*
Bacteroidota	Bacteroidaceae	*Phocaeicola*	*Phocaeicola vulgatus*

Bacteroidota	Hymenobacteraceae	*Pontibacter*	*Pontibacter mucosus*
Bacteroidota	Porphyromonadaceae	*Porphyromonas*	*Porphyromonas catoniae*
Bacteroidota	Porphyromonadaceae	*Porphyromonas*	*Porphyromonas circumdentaria*
Bacteroidota	Bacteroidaceae	*Prevotellamassilia*	*Prevotellamassilia timonensis*
Bacteroidota	Dysgonomonadaceae	*Proteiniphilum*	*Proteiniphilum acetatigenes*
Bacteroidota	Thermonemataceae	*Raineya*	*Raineya orbicola*
Bacteroidota	Rhodothermaceae	*Rhodothermus*	*Rhodothermus marinus*
Bacteroidota	Rikenellaceae	*Rikenella*	*Rikenella microfusus*
Bacteroidota	Marinilabiliaceae	*Saccharicrinis*	*Saccharicrinis aurantiacus*
Bacteroidota	Marinilabiliaceae	*Saccharicrinis*	*Saccharicrinis carchari*
Bacteroidota	Salibacteraceae	*Salibacter*	*Salibacter halophilus*
Bacteroidota	Flavobacteriaceae	*Sediminibacter*	*Sediminibacter furfurosus*
Bacteroidota	Tannerellaceae	*Tannerella*	*Tannerella forsythia*
Bacteroidota	Chitinophagaceae	*Terrimonas*	*Terrimonas terrae*
Bacteroidota	Rikenellaceae	*Tidjanibacter*	*Tidjanibacter massiliensis*
Bacteroidota	Williamwhitmaniaceae	*Williamwhitmania*	*Williamwhitmania taraxaci*
Bdellovibrionota	Bdellovibrionaceae	*Bdellovibrio*	*Bdellovibrio exovorus*
Campylobacterota	Arcobacteraceae	*Aliarcobacter*	*Aliarcobacter cibarius*
Campylobacterota	Arcobacteraceae	*Arcobacter*	*Arcobacter aquimarinus*
Campylobacterota	Campylobacteraceae	*Campylobacter*	*Campylobacter fetus*
Campylobacterota	Campylobacteraceae	*Campylobacter*	*Campylobacter iguaniorum*
Campylobacterota	Campylobacteraceae	*Campylobacter*	*Campylobacter insulaenigrae*

Campylobacterota	Campylobacteraceae	*Campylobacter*	*Campylobacter subantarcticus*
Campylobacterota	Campylobacteraceae	*Campylobacter*	*Campylobacter troglodytis*
Campylobacterota	Campylobacteraceae	*Campylobacter*	*Campylobacter volucris*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter anseris*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter aurati*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter bilis*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter brantae*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter canadensis*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter canis*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter cetorum*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter cholecystus*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter cinaedi*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter equorum*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter fennelliae*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter ganmani*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter hepaticus*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter himalayensis*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter jaachi*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter japonicus*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter marmotae*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter mastomyrinus*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter mesocricetorum*

Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter muridarum*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter mustelae*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter pametensis*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter pullorum*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter pylori*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter rodentium*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter trogontum*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter typhlonius*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter valdiviensis*
Campylobacterota	Helicobacteraceae	*Helicobacter*	*Helicobacter winghamensis*
Campylobacterota	Helicobacteraceae	*Heliomicrobium*	*Heliomicrobium modesticaldum*
Campylobacterota	Hippeaceae	*Hippea*	*Hippea jasoniae*
Campylobacterota	Hippeaceae	*Hippea*	*Hippea maritima*
Campylobacterota	Arcobacteraceae	*Malaciobacter*	*Malaciobacter mytili*
Campylobacterota	Sulfurospirillaceae	*Sulfurospirillum*	*Sulfurospirillum multivorans*
Campylobacterota	Helicobacteraceae	*Wolinella*	*Wolinella succinogenes*
Chloroflexota	Caldilineaceae	*Caldilinea*	*Caldilinea tarbellica*
Chloroflexota	Herpetosiphonaceae	*Herpetosiphon*	*Herpetosiphon giganteus*
Chloroflexota	Herpetosiphonaceae	*Herpetosiphon*	*Herpetosiphon gulosus*
Chloroflexota	Thermomicrobiaceae	*Sphaerobacter*	*Sphaerobacter thermophilus*
Chrysiogenetota	Chrysiogenaceae	*Chrysiogenes*	*Chrysiogenes arsenatis*
Chrysiogenetota	Chrysiogenaceae	*Desulfurispirillum*	*Desulfurispirillum indicum*

Cyanobacteriota	Thermosynechococcaceae	*Acaryochloris*	*Acaryochloris marina*
Cyanobacteriota	Oscillatoriaceae	*Aerosakkonema*	*Aerosakkonema funiforme*
Cyanobacteriota	Chroococcidiopsidaceae	*Aliterella*	*Aliterella antarctica*
Cyanobacteriota	Nostocaceae	*Anabaena*	*Anabaena cylindrica*
Cyanobacteriota	Scytonemataceae	*Brasilonema*	*Brasilonema angustatum*
Cyanobacteriota	Scytonemataceae	*Brasilonema*	*Brasilonema bromeliae*
Cyanobacteriota	Scytonemataceae	*Brasilonema*	*Brasilonema terrestre*
Cyanobacteriota	Nostocaceae	*Calothrix*	*Calothrix desertica*
Cyanobacteriota	Coleofasciculaceae	*Cephalothrix*	*Cephalothrix komarekiana*
Cyanobacteriota	Coleofasciculaceae	*Cephalothrix*	*Cephalothrix lacustris*
Cyanobacteriota	Chamaesiphonaceae	*Chamaesiphon*	*Chamaesiphon minutus*
Cyanobacteriota	Chroococcidiopsidaceae	*Chroococcidiopsis*	*Chroococcidiopsis thermalis*
Cyanobacteriota	Chamaesiphonaceae	*Crinalium*	*Crinalium epipsammum*
Cyanobacteriota	Nostocaceae	*Cylindrospermum*	*Cylindrospermum pellucidum*
Cyanobacteriota	Nostocaceae	*Cylindrospermum*	*Cylindrospermum stagnale*
Cyanobacteriota	Dapisostemonaceae	*Dapisostemon*	*Dapisostemon apicaliramis*
Cyanobacteriota	Calotrichaceae	*Dulcicalothrix*	*Dulcicalothrix necridiiformans*
Cyanobacteriota	Gloeobacteraceae	*Gloeobacter*	*Gloeobacter kilaueensis*
Cyanobacteriota	Gloeobacteraceae	*Gloeobacter*	*Gloeobacter violaceus*
Cyanobacteriota	Chroococcaceae	*Gloeocapsopsis*	*Gloeocapsopsis crepidinum*
Cyanobacteriota	Chroococcaceae	*Gloeocapsopsis*	*Gloeocapsopsis diffluens*
Cyanobacteriota	Microcystaceae	*Gloeothece*	*Gloeothece membranacea*

Cyanobacteriota	Prochlorotrichaceae	*Haloleptolyngbya*	*Haloleptolyngbya alcalis*
Cyanobacteriota	Prochlorotrichaceae	*Halomicronema*	*Halomicronema excentricum*
Cyanobacteriota	Nostocaceae	*Komarekiella*	*Komarekiella atlantica*
Cyanobacteriota	Tolypothrichaceae	*Kryptousia*	*Kryptousia macronema*
Cyanobacteriota	Tolypothrichaceae	*Kryptousia*	*Kryptousia microlepis*
Cyanobacteriota	Leptolyngbyaceae	*Leptodesmis*	*Leptodesmis alaskaensis*
Cyanobacteriota	Symphyonemataceae	*Loriellopsis*	*Loriellopsis cavernicola*
Cyanobacteriota	Phormidiaceae	*Lyngbya*	*Lyngbya aestuarii*
Cyanobacteriota	Phormidiaceae	*Microcoleus*	*Microcoleus anatoxicus*
Cyanobacteriota	Microcystaceae	*Microcystis*	*Microcystis aeruginosa*
Cyanobacteriota	Phormidiaceae	*Okeania*	*Okeania plumata*
Cyanobacteriota	Oscillatoriaceae	*Oscillatoria*	*Oscillatoria acuminata*
Cyanobacteriota	Oscillatoriaceae	*Oscillatoria*	*Oscillatoria nigro-viridis*
Cyanobacteriota	Oscillatoriaceae	*Oscillatoria*	*Oscillatoria sancta*
Cyanobacteriota	Phormidiaceae	*Planktothrix*	*Planktothrix agardhii*
Cyanobacteriota	Phormidiaceae	*Planktothrix*	*Planktothrix spiroides*
Cyanobacteriota	Prochlorotrichaceae	*Prochlorothrix*	*Prochlorothrix hollandica*
Cyanobacteriota	Chroococcaceae	*Pseudochroococcus*	*Pseudochroococcus couteii*
Cyanobacteriota	Spirulinaceae	*Spirulina*	*Spirulina major*
Cyanobacteriota	Xenococcaceae	*Stanieria*	*Stanieria cyanosphaera*
Cyanobacteriota	Symphyonemataceae	*Symphyonema*	*Symphyonema bifilamentata*
Cyanobacteriota	Microcoleaceae	*Tychonema*	*Tychonema bourrellyi*

Cyanobacteriota	Vampirovibrionaceae	*Vampirovibrio*	*Vampirovibrio chlorellavorus*
Deferribacterota	Calditerrivibrionaceae	*Calditerrivibrio*	*Calditerrivibrio nitroreducens*
Deferribacterota	Deferribacteraceae	*Deferribacter*	*Deferribacter autotrophicus*
Deferribacterota	Deferribacteraceae	*Deferribacter*	*Deferribacter desulfuricans*
Deferribacterota	Denitrovibrionaceae	*Geovibrio*	*Geovibrio ferrireducens*
Deferribacterota	Mucispirillaceae	*Mucispirillum*	*Mucispirillum schaedleri*
Desulfobacterota	Desulfobacteraceae	*Algorimarina*	*Algorimarina butyrica*
Desulfobacterota	Geobacteraceae	*Citrifermentans*	*Citrifermentans bemidjiense*
Desulfobacterota	Desulfovibrionaceae	*Cupidesulfovibrio*	*Cupidesulfovibrio oxamicus*
Desulfobacterota	Desulfovibrionaceae	*Cupidesulfovibrio*	*Cupidesulfovibrio termitidis*
Desulfobacterota	Desulfarculaceae	*Desulfarculus*	*Desulfarculus baarsii*
Desulfobacterota	Desulfatibacillaceae	*Desulfatibacillum*	*Desulfatibacillum alkenivorans*
Desulfobacterota	Desulfobacteraceae	*Desulfatiferula*	*Desulfatiferula berrensis*
Desulfobacterota	Desulfobacteraceae	*Desulfatiferula*	*Desulfatiferula olefinivorans*
Desulfobacterota	Desulfatiglandaceae	*Desulfatiglans*	*Desulfatiglans anilini*
Desulfobacterota	Desulfatiglandaceae	*Desulfatiglans*	*Desulfatiglans parachlorophenolica*
Desulfobacterota	Desulfatirhabdiaceae	*Desulfatirhabdium*	*Desulfatirhabdium butyrativorans*
Desulfobacterota	Desulfosarcinaceae	*Desulfatitalea*	*Desulfatitalea tepidiphila*
Desulfobacterota	Desulfobacteraceae	*Desulfobacter*	*Desulfobacter curvatus*
Desulfobacterota	Desulfobacteraceae	*Desulfobacter*	*Desulfobacter hydrogenophilus*
Desulfobacterota	Desulfobacteraceae	*Desulfobacter*	*Desulfobacter latus*
Desulfobacterota	Desulfobacteraceae	*Desulfobacterium*	*Desulfobacterium indolicum*

Desulfobacterota	Desulfobacteraceae	*Desulfobacula*	*Desulfobacula phenolica*
Desulfobacterota	Desulfobacteraceae	*Desulfobacula*	*Desulfobacula toluolica*
Desulfobacterota	Desulforegulaceae	*Desulfobotulus*	*Desulfobotulus mexicanus*
Desulfobacterota	Desulforegulaceae	*Desulfobotulus*	*Desulfobotulus sapovorans*
Desulfobacterota	Desulfobulbaceae	*Desulfobulbus*	*Desulfobulbus oligotrophicus*
Desulfobacterota	Desulfobulbaceae	*Desulfobulbus*	*Desulfobulbus propionicus*
Desulfobacterota	Desulfococcaceae	*Desulfococcus*	*Desulfococcus biacutus*
Desulfobacterota	Desulfococcaceae	*Desulfococcus*	*Desulfococcus multivorans*
Desulfobacterota	Desulfofabaceae	*Desulfofaba*	*Desulfofaba fastidiosa*
Desulfobacterota	Desulfofabaceae	*Desulfofaba*	*Desulfofaba gelida*
Desulfobacterota	Desulfofabaceae	*Desulfofaba*	*Desulfofaba hansenii*
Desulfobacterota	Desulfobacteraceae	*Desulfofrigus*	*Desulfofrigus oceanense*
Desulfobacterota	Syntrophobacteraceae	*Desulfoglaeba*	*Desulfoglaeba alkanexedens*
Desulfobacterota	Desulfolunaceae	*Desulfoluna*	*Desulfoluna spongiiphila*
Desulfobacterota	Desulfomicrobiaceae	*Desulfomicrobium*	*Desulfomicrobium baculatum*
Desulfobacterota	Desulfomonilaceae	*Desulfomonile*	*Desulfomonile limimaris*
Desulfobacterota	Desulfomonilaceae	*Desulfomonile*	*Desulfomonile tiedjei*
Desulfobacterota	Desulfobacteraceae	*Desulfonatronobacter*	*Desulfonatronobacter acetoxydans*
Desulfobacterota	Desulfobacteraceae	*Desulfonatronobacter*	*Desulfonatronobacter acidivorans*
Desulfobacterota	Desulfonatronovibrionaceae	*Desulfonatronovibrio*	*Desulfonatronovibrio halophilus*

Desulfobacterota	Desulfonatronovibrionaceae	*Desulfonatronovibrio*	*Desulfonatronovibrio hydrogenovorans*
Desulfobacterota	Desulfonatronovibrionaceae	*Desulfonatronovibrio*	*Desulfonatronovibrio magnus*
Desulfobacterota	Desulfonatronaceae	*Desulfonatronum*	*Desulfonatronum lacustre*
Desulfobacterota	Desulfonatronaceae	*Desulfonatronum*	*Desulfonatronum thioautotrophicum*
Desulfobacterota	Desulfococcaceae	*Desulfonema*	*Desulfonema ishimotonii*
Desulfobacterota	Desulfococcaceae	*Desulfonema*	*Desulfonema limicola*
Desulfobacterota	Desulfococcaceae	*Desulfonema*	*Desulfonema magnum*
Desulfobacterota	Desulfoplanaceae	*Desulfoplanes*	*Desulfoplanes formicivorans*
Desulfobacterota	Desulfobacteraceae	*Desulforapulum*	*Desulforapulum autotrophicum*
Desulfobacterota	Desulforegulaceae	*Desulforegula*	*Desulforegula conservatrix*
Desulfobacterota	Desulfosalsimonadaceae	*Desulfosalsimonas*	*Desulfosalsimonas propionicica*
Desulfobacterota	Desulfosarcinaceae	*Desulfosarcina*	*Desulfosarcina alkanivorans*
Desulfobacterota	Desulfosarcinaceae	*Desulfosarcina*	*Desulfosarcina cetonica*
Desulfobacterota	Desulfosarcinaceae	*Desulfosarcina*	*Desulfosarcina variabilis*
Desulfobacterota	Desulfosarcinaceae	*Desulfosarcina*	*Desulfosarcina widdelii*
Desulfobacterota	Desulfovibrionaceae	*Desulfovibrio*	*Desulfovibrio alaskensis*
Desulfobacterota	Desulfovibrionaceae	*Desulfovibrio*	*Desulfovibrio carbinoliphilus*
Desulfobacterota	Desulfovibrionaceae	*Desulfovibrio*	*Desulfovibrio cuneatus*
Desulfobacterota	Desulfovibrionaceae	*Desulfovibrio*	*Desulfovibrio desulfuricans*
Desulfobacterota	Desulfovibrionaceae	*Desulfovibrio*	*Desulfovibrio gigas*

Desulfobacterota	Desulfovibrionaceae	*Desulfovibrio*	*Desulfovibrio inopinatus*
Desulfobacterota	Desulfovibrionaceae	*Desulfovibrio*	*Desulfovibrio intestinalis*
Desulfobacterota	Desulfovibrionaceae	*Desulfovibrio*	*Desulfovibrio legallii*
Desulfobacterota	Desulfovibrionaceae	*Desulfovibrio*	*Desulfovibrio litoralis*
Desulfobacterota	Desulfovibrionaceae	*Desulfovibrio*	*Desulfovibrio longreachensis*
Desulfobacterota	Desulfovibrionaceae	*Desulfovibrio*	*Desulfovibrio oxamicus*
Desulfobacterota	Desulfovibrionaceae	*Desulfovibrio*	*Desulfovibrio piger*
Desulfobacterota	Desulfovibrionaceae	*Desulfovibrio*	*Desulfovibrio psychrotolerans*
Desulfobacterota	Desulfovibrionaceae	*Desulfovibrio*	*Desulfovibrio senegalensis*
Desulfobacterota	Desulfovibrionaceae	*Desulfovibrio*	*Desulfovibrio simplex*
Desulfobacterota	Desulfovibrionaceae	*Desulfovibrio*	*Desulfovibrio tunisiensis*
Desulfobacterota	Desulfovibrionaceae	*Desulfovibrio*	*Desulfovibrio vietnamensis*
Desulfobacterota	Desulfovibrionaceae	*Desulfovibrio*	*Desulfovibrio vulgaris*
Desulfobacterota	Syntrophobacteraceae	*Desulfovirga*	*Desulfovirga adipica*
Desulfobacterota	Desulfuromonadaceae	*Desulfuromonas*	*Desulfuromonas acetoxidans*
Desulfobacterota	Desulfuromonadaceae	*Desulfuromonas*	*Desulfuromonas michiganensis*
Desulfobacterota	Desulfuromonadaceae	*Desulfuromonas*	*Desulfuromonas palmitatis*
Desulfobacterota	Desulfuromonadaceae	*Desulfuromonas*	*Desulfuromonas svalbardensis*
Desulfobacterota	Desulfuromonadaceae	*Desulfuromonas*	*Desulfuromonas thiophila*
Desulfobacterota	Desulfarculaceae	*Dethiosulfatarculus*	*Dethiosulfatarculus sandiegensis*
Desulfobacterota	Geoalkalibacteraceae	*Geoalkalibacter*	*Geoalkalibacter ferrihydriticus*
Desulfobacterota	Geobacteraceae	*Geobacter*	*Geobacter anodireducens*

Desulfobacterota	Geobacteraceae	*Geobacter*	*Geobacter chapellei*
Desulfobacterota	Geobacteraceae	*Geobacter*	*Geobacter grbiciae*
Desulfobacterota	Geobacteraceae	*Geobacter*	*Geobacter lovleyi*
Desulfobacterota	Geobacteraceae	*Geobacter*	*Geobacter luticola*
Desulfobacterota	Geobacteraceae	*Geobacter*	*Geobacter metallireducens*
Desulfobacterota	Geobacteraceae	*Geobacter*	*Geobacter pickeringii*
Desulfobacterota	Geobacteraceae	*Geobacter*	*Geobacter psychrophilus*
Desulfobacterota	Geobacteraceae	*Geobacter*	*Geobacter soli*
Desulfobacterota	Geobacteraceae	*Geobacter*	*Geobacter sulfurreducens*
Desulfobacterota	Geobacteraceae	*Geobacter*	*Geobacter thiogenes*
Desulfobacterota	Geobacteraceae	*Geobacter*	*Geobacter uraniireducens*
Desulfobacterota	Desulfovibrionaceae	*Lawsonia*	*Lawsonia intracellularis*
Desulfobacterota	Desulfovibrionaceae	*Mailhella*	*Mailhella massiliensis*
Desulfobacterota	Desulfovibrionaceae	*Maridesulfovibrio*	*Maridesulfovibrio hydrothermalis*
Desulfobacterota	Desulfuromonadaceae	*Pelobacter*	*Pelobacter carbinolicus*
Desulfobacterota	Desulfuromonadaceae	*Pelobacter*	*Pelobacter propionicus*
Desulfobacterota	Desulfuromonadaceae	*Pelobacter*	*Pelobacter seleniigenes*
Desulfobacterota	Syntrophobacteraceae	*Pelospora*	*Pelospora glutarica*
Desulfobacterota	Desulfovibrionaceae	*Pseudodesulfovibrio*	*Pseudodesulfovibrio aespoeensis*
Desulfobacterota	Desulfovibrionaceae	*Pseudodesulfovibrio*	*Pseudodesulfovibrio alkaliphilus*
Desulfobacterota	Syntrophobacteraceae	*Syntrophobacter*	*Syntrophobacter fumaroxidans*
Desulfobacterota	Syntrophobacteraceae	*Syntrophobacter*	*Syntrophobacter sulfatireducens*

Desulfobacterota	Syntrophorhabdaceae	*Syntrophorhabdus*	*Syntrophorhabdus aromaticivorans*
Desulfobacterota	Syntrophotaleaceae	*Syntrophotalea*	*Syntrophotalea acetylenica*
Desulfobacterota	Syntrophotaleaceae	*Syntrophotalea*	*Syntrophotalea carbinolica*
Desulfobacterota	Syntrophaceae	*Syntrophus*	*Syntrophus aciditrophicus*
Desulfobacterota	Syntrophaceae	*Syntrophus*	*Syntrophus buswellii*
Desulfobacterota	Syntrophaceae	*Syntrophus*	*Syntrophus gentianae*
Fusobacteriota	Fusobacteriaceae	*Cetobacterium*	*Cetobacterium somerae*
Fusobacteriota	Fusobacteriaceae	*Fusobacterium*	*Fusobacterium gastrosuis*
Fusobacteriota	Fusobacteriaceae	*Fusobacterium*	*Fusobacterium mortiferum*
Fusobacteriota	Fusobacteriaceae	*Fusobacterium*	*Fusobacterium necrophorum*
Fusobacteriota	Fusobacteriaceae	*Fusobacterium*	*Fusobacterium nucleatum*
Fusobacteriota	Fusobacteriaceae	*Fusobacterium*	*Fusobacterium periodonticum*
Fusobacteriota	Fusobacteriaceae	*Fusobacterium*	*Fusobacterium varium*
Fusobacteriota	Fusobacteriaceae	*Ilyobacter*	*Ilyobacter delafieldii*
Fusobacteriota	Leptotrichiaceae	*Sebaldella*	*Sebaldella termitidis*
Gemmatimonadetes	Longimicrobiaceae	*Longimicrobium*	*Longimicrobium terrae*
Gemmatimonadota	Gemmatimonadaceae	*Gemmatimonas*	*Gemmatimonas phototrophica*
Myxococcota	Myxococcaceae	*Corallococcus*	*Corallococcus coralloides*
Myxococcota	Myxococcaceae	*Corallococcus*	*Corallococcus exiguus*
Myxococcota	Myxococcaceae	*Myxococcus*	*Myxococcus fulvus*
Myxococcota	Myxococcaceae	*Vitiosangium*	*Vitiosangium cumulatum*
Nitrospirota	Thermodesulfovibrionaceae	*Thermodesulfovibrio*	*Thermodesulfovibrio aggregans*

Planctomycetota	Isosphaeraceae	*Aquisphaera*	*Aquisphaera giovannonii*
Planctomycetota	Pirellulaceae	*Aureliella*	*Aureliella helgolandensis*
Planctomycetota	Pirellulaceae	*Blastopirellula*	*Blastopirellula marina*
Planctomycetota	Lacipirellulaceae	*Botrimarina*	*Botrimarina hoheduenensis*
Planctomycetota	Lacipirellulaceae	*Bythopirellula*	*Bythopirellula goksoyri*
Planctomycetota	Planctomycetaceae	*Crateriforma*	*Crateriforma conspicua*
Planctomycetota	Gemmataceae	*Gemmata*	*Gemmata massiliana*
Planctomycetota	Gemmataceae	*Gemmata*	*Gemmata obscuriglobus*
Planctomycetota	Isosphaeraceae	*Paludisphaera*	*Paludisphaera borealis*
Planctomycetota	Lacipirellulaceae	*Pirellulimonas*	*Pirellulimonas nuda*
Planctomycetota	Lacipirellulaceae	*Posidoniimonas*	*Posidoniimonas corsicana*
Planctomycetota	Planctomycetaceae	*Rubinisphaera*	*Rubinisphaera brasiliensis*
Planctomycetota	Planctomycetaceae	*Rubinisphaera*	*Rubinisphaera italica*
Planctomycetota	Isosphaeraceae	*Singulisphaera*	*Singulisphaera acidiphila*
Planctomycetota	Isosphaeraceae	*Singulisphaera*	*Singulisphaera rosea*
Planctomycetota	Planctomycetaceae	*Symmachiella*	*Symmachiella macrocystis*
Planctomycetota	Gemmataceae	*Telmatocola*	*Telmatocola sphagniphila*
Planctomycetota	Thermoguttaceae	*Thermogutta*	*Thermogutta hypogea*
Planctomycetota	Thermoguttaceae	*Thermogutta*	*Thermogutta terrifontis*
Planctomycetota	Thermoguttaceae	*Thermostilla*	*Thermostilla marina*
Planctomycetota	Isosphaeraceae	*Tundrisphaera*	*Tundrisphaera lichenicola*
Planctomycetota	Gemmataceae	*Urbifossiella*	*Urbifossiella limnaea*

Pseudomonadota	Acetobacteraceae	*Acetobacter*	*Acetobacter aceti*
Pseudomonadota	Acetobacteraceae	*Acetobacter*	*Acetobacter cerevisiae*
Pseudomonadota	Acetobacteraceae	*Acetobacter*	*Acetobacter cibinongensis*
Pseudomonadota	Acetobacteraceae	*Acetobacter*	*Acetobacter estunensis*
Pseudomonadota	Acetobacteraceae	*Acetobacter*	*Acetobacter fabarum*
Pseudomonadota	Acetobacteraceae	*Acetobacter*	*Acetobacter ghanensis*
Pseudomonadota	Acetobacteraceae	*Acetobacter*	*Acetobacter indonesiensis*
Pseudomonadota	Acetobacteraceae	*Acetobacter*	*Acetobacter lambici*
Pseudomonadota	Acetobacteraceae	*Acetobacter*	*Acetobacter lovaniensis*
Pseudomonadota	Acetobacteraceae	*Acetobacter*	*Acetobacter okinawensis*
Pseudomonadota	Acetobacteraceae	*Acetobacter*	*Acetobacter orientalis*
Pseudomonadota	Acetobacteraceae	*Acetobacter*	*Acetobacter orleanensis*
Pseudomonadota	Acetobacteraceae	*Acetobacter*	*Acetobacter papayae*
Pseudomonadota	Acetobacteraceae	*Acetobacter*	*Acetobacter peroxydans*
Pseudomonadota	Acetobacteraceae	*Acetobacter*	*Acetobacter persici*
Pseudomonadota	Acetobacteraceae	*Acetobacter*	*Acetobacter pomorum*
Pseudomonadota	Acetobacteraceae	*Acetobacter*	*Acetobacter sicerae*
Pseudomonadota	Acetobacteraceae	*Acetobacter*	*Acetobacter syzygii*
Pseudomonadota	Acetobacteraceae	*Acetobacter*	*Acetobacter thailandicus*
Pseudomonadota	Acetobacteraceae	*Acetobacter*	*Acetobacter tropicalis*
Pseudomonadota	Burkholderiaceae	*Achromobacter*	*Achromobacter aegrifaciens*
Pseudomonadota	Burkholderiaceae	*Achromobacter*	*Achromobacter deleyi*

Pseudomonadota	Burkholderiaceae	*Achromobacter*	*Achromobacter denitrificans*
Pseudomonadota	Burkholderiaceae	*Achromobacter*	*Achromobacter insuavis*
Pseudomonadota	Burkholderiaceae	*Achromobacter*	*Achromobacter kerstersii*
Pseudomonadota	Burkholderiaceae	*Achromobacter*	*Achromobacter marplatensis*
Pseudomonadota	Burkholderiaceae	*Achromobacter*	*Achromobacter mucicolens*
Pseudomonadota	Burkholderiaceae	*Achromobacter*	*Achromobacter pestifer*
Pseudomonadota	Burkholderiaceae	*Achromobacter*	*Achromobacter pulmonis*
Pseudomonadota	Acidiferrobacteraceae	*Acidiferrobacter*	*Acidiferrobacter thiooxydans*
Pseudomonadota	Acetobacteraceae	*Acidiphilium*	*Acidiphilium multivorum*
Pseudomonadota	Acetobacteraceae	*Acidisphaera*	*Acidisphaera rubrifaciens*
Pseudomonadota	Comamonadaceae	*Acidovorax*	*Acidovorax caeni*
Pseudomonadota	Comamonadaceae	*Acidovorax*	*Acidovorax citrulli*
Pseudomonadota	Comamonadaceae	*Acidovorax*	*Acidovorax temperans*
Pseudomonadota	Comamonadaceae	*Acidovorax*	*Acidovorax wautersii*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter albensis*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter antiviralis*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter apis*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter baumannii*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter baylyi*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter calcoaceticus*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter chinensis*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter colistiniresistens*

Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter courvalinii*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter defluvii*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter dispersus*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter equi*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter gerneri*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter haemolyticus*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter halotolerans*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter indicus*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter johnsonii*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter lactucae*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter lwoffii*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter modestus*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter nosocomialis*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter oleivorans*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter piscicola*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter pittii*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter populi*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter pragensis*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter proteolyticus*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter radioresistens*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter seifertii*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter septicus*

Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter soli*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter tandoii*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter tjernbergiae*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter variabilis*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter venetianus*
Pseudomonadota	Moraxellaceae	*Acinetobacter*	*Acinetobacter vivianii*
Pseudomonadota	Pasteurellaceae	*Actinobacillus*	*Actinobacillus anseriformium*
Pseudomonadota	Pasteurellaceae	*Actinobacillus*	*Actinobacillus arthritidis*
Pseudomonadota	Pasteurellaceae	*Actinobacillus*	*Actinobacillus capsulatus*
Pseudomonadota	Pasteurellaceae	*Actinobacillus*	*Actinobacillus delphinicola*
Pseudomonadota	Pasteurellaceae	*Actinobacillus*	*Actinobacillus equuli*
Pseudomonadota	Pasteurellaceae	*Actinobacillus*	*Actinobacillus hominis*
Pseudomonadota	Pasteurellaceae	*Actinobacillus*	*Actinobacillus indolicus*
Pseudomonadota	Pasteurellaceae	*Actinobacillus*	*Actinobacillus lignieresii*
Pseudomonadota	Pasteurellaceae	*Actinobacillus*	*Actinobacillus minor*
Pseudomonadota	Pasteurellaceae	*Actinobacillus*	*Actinobacillus pleuropneumoniae*
Pseudomonadota	Pasteurellaceae	*Actinobacillus*	*Actinobacillus porcinus*
Pseudomonadota	Pasteurellaceae	*Actinobacillus*	*Actinobacillus rossii*
Pseudomonadota	Pasteurellaceae	*Actinobacillus*	*Actinobacillus scotiae*
Pseudomonadota	Pasteurellaceae	*Actinobacillus*	*Actinobacillus seminis*
Pseudomonadota	Pasteurellaceae	*Actinobacillus*	*Actinobacillus succinogenes*
Pseudomonadota	Pasteurellaceae	*Actinobacillus*	*Actinobacillus suis*

Pseudomonadota	Pasteurellaceae	*Actinobacillus*	*Actinobacillus ureae*
Pseudomonadota	Burkholderiaceae	*Advenella*	*Advenella kashmirensis*
Pseudomonadota	Burkholderiaceae	*Advenella*	*Advenella mimigardefordensis*
Pseudomonadota	Aeromonadaceae	*Aeromonas*	*Aeromonas cavernicola*
Pseudomonadota	Aeromonadaceae	*Aeromonas*	*Aeromonas caviae*
Pseudomonadota	Aeromonadaceae	*Aeromonas*	*Aeromonas dhakensis*
Pseudomonadota	Aeromonadaceae	*Aeromonas*	*Aeromonas diversa*
Pseudomonadota	Aeromonadaceae	*Aeromonas*	*Aeromonas encheleia*
Pseudomonadota	Aeromonadaceae	*Aeromonas*	*Aeromonas enteropelogenes*
Pseudomonadota	Aeromonadaceae	*Aeromonas*	*Aeromonas hydrophila*
Pseudomonadota	Aeromonadaceae	*Aeromonas*	*Aeromonas jandaei*
Pseudomonadota	Aeromonadaceae	*Aeromonas*	*Aeromonas media*
Pseudomonadota	Aeromonadaceae	*Aeromonas*	*Aeromonas molluscorum*
Pseudomonadota	Aeromonadaceae	*Aeromonas*	*Aeromonas rivipollensis*
Pseudomonadota	Aeromonadaceae	*Aeromonas*	*Aeromonas rivuli*
Pseudomonadota	Aeromonadaceae	*Aeromonas*	*Aeromonas salmonicida*
Pseudomonadota	Aeromonadaceae	*Aeromonas*	*Aeromonas sanarellii*
Pseudomonadota	Aeromonadaceae	*Aeromonas*	*Aeromonas schubertii*
Pseudomonadota	Aeromonadaceae	*Aeromonas*	*Aeromonas simiae*
Pseudomonadota	Aeromonadaceae	*Aeromonas*	*Aeromonas taiwanensis*
Pseudomonadota	Aeromonadaceae	*Aeromonas*	*Aeromonas tecta*
Pseudomonadota	Pectobacteriaceae	*Affinibrenneria*	*Affinibrenneria salicis*

Pseudomonadota	Xanthobacteraceae	*Afipia*	*Afipia clevelandensis*
Pseudomonadota	Xanthobacteraceae	*Afipia*	*Afipia felis*
Pseudomonadota	Psychromonadaceae	*Agarivorans*	*Agarivorans aestuarii*
Pseudomonadota	Pasteurellaceae	*Aggregatibacter*	*Aggregatibacter actinomycetemcomitans*
Pseudomonadota	Pasteurellaceae	*Aggregatibacter*	*Aggregatibacter aphrophilus*
Pseudomonadota	Pasteurellaceae	*Aggregatibacter*	*Aggregatibacter segnis*
Pseudomonadota	Rhizobiaceae	*Agrobacterium*	*Agrobacterium salinitolerans*
Pseudomonadota	Rhizobiaceae	*Ahrensia*	*Ahrensia kielensis*
Pseudomonadota	Rhizobiaceae	*Ahrensia*	*Ahrensia marina*
Pseudomonadota	Rhodobacteraceae	*Albirhodobacter*	*Albirhodobacter confluentis*
Pseudomonadota	Burkholderiaceae	*Alcaligenes*	*Alcaligenes aquatilis*
Pseudomonadota	Burkholderiaceae	*Alcaligenes*	*Alcaligenes endophyticus*
Pseudomonadota	Burkholderiaceae	*Alcaligenes*	*Alcaligenes faecalis*
Pseudomonadota	Alcanivoracaceae	*Alcanivorax*	*Alcanivorax jadensis*
Pseudomonadota	Alcanivoracaceae	*Alcanivorax*	*Alcanivorax marinus*
Pseudomonadota	Alteromonadaceae	*Algicola*	*Algicola bacteriolytica*
Pseudomonadota	Psychromonadaceae	*Alginatibacterium*	*Alginatibacterium sediminis*
Pseudomonadota	Alteromonadaceae	*Aliidiomarina*	*Aliidiomarina maris*
Pseudomonadota	Alteromonadaceae	*Aliidiomarina*	*Aliidiomarina soli*
Pseudomonadota	Vibrionaceae	*Aliivibrio*	*Aliivibrio finisterrensis*
Pseudomonadota	Vibrionaceae	*Aliivibrio*	*Aliivibrio fischeri*
Pseudomonadota	Vibrionaceae	*Aliivibrio*	*Aliivibrio logei*

Pseudomonadota	Vibrionaceae	*Aliivibrio*	*Aliivibrio salmonicida*
Pseudomonadota	Vibrionaceae	*Aliivibrio*	*Aliivibrio wodanis*
Pseudomonadota	Alteromonadaceae	*Alishewanella*	*Alishewanella alkalitolerans*
Pseudomonadota	Alteromonadaceae	*Alishewanella*	*Alishewanella jeotgali*
Pseudomonadota	Alteromonadaceae	*Alkalimonas*	*Alkalimonas amylolytica*
Pseudomonadota	Alteromonadaceae	*Alkalimonas*	*Alkalimonas collagenimarina*
Pseudomonadota	Alteromonadaceae	*Alkalimonas*	*Alkalimonas delamerensis*
Pseudomonadota	Alteromonadaceae	*Alteromonas*	*Alteromonas mediterranea*
Pseudomonadota	Rhodobacteraceae	*Amaricoccus*	*Amaricoccus kaplicensis*
Pseudomonadota	Rhodobacteraceae	*Amaricoccus*	*Amaricoccus macauensis*
Pseudomonadota	Rhodobacteraceae	*Amaricoccus*	*Amaricoccus tamworthensis*
Pseudomonadota	Rhodobacteraceae	*Amaricoccus*	*Amaricoccus veronensis*
Pseudomonadota	Acetobacteraceae	*Ameyamaea*	*Ameyamaea chiangmaiensis*
Pseudomonadota	Rhizobiaceae	*Aminobacter*	*Aminobacter aminovorans*
Pseudomonadota	Rhizobiaceae	*Aminobacter*	*Aminobacter anthyllidis*
Pseudomonadota	Amorphaceae	*Amorphus*	*Amorphus coralli*
Pseudomonadota	Nitrincolaceae	*Amphritea*	*Amphritea spongicola*
Pseudomonadota	Succinivibrionaceae	*Anaerobiospirillum*	*Anaerobiospirillum thomasii*
Pseudomonadota	Anaplasmataceae	*Anaplasma*	*Anaplasma phagocytophilum*
Pseudomonadota	Xanthobacteraceae	*Ancylobacter*	*Ancylobacter rudongensis*
Pseudomonadota	Burkholderiaceae	*Aquabacterium*	*Aquabacterium commune*
Pseudomonadota	Phyllobacteriaceae	*Aquamicrobium*	*Aquamicrobium segne*

Pseudomonadota	Phyllobacteriaceae	*Aquamicrobium*	*Aquamicrobium terrae*
Pseudomonadota	Coxiellaceae	*Aquicella*	*Aquicella lusitana*
Pseudomonadota	Burkholderiaceae	*Aquincola*	*Aquincola amnicola*
Pseudomonadota	Aquisalimonadaceae	*Aquisalimonas*	*Aquisalimonas halophila*
Pseudomonadota	Arenicellaceae	*Arenicella*	*Arenicella chitinivorans*
Pseudomonadota	Xanthomonadaceae	*Arenimonas*	*Arenimonas aquatica*
Pseudomonadota	Xanthomonadaceae	*Arenimonas*	*Arenimonas metalli*
Pseudomonadota	Rhodocyclaceae	*Aromatoleum*	*Aromatoleum bremense*
Pseudomonadota	Rhodocyclaceae	*Aromatoleum*	*Aromatoleum pumilum*
Pseudomonadota	Alteromonadaceae	*Arsukibacterium*	*Arsukibacterium ikkense*
Pseudomonadota	Acetobacteraceae	*Asaia*	*Asaia astilbis*
Pseudomonadota	Acetobacteraceae	*Asaia*	*Asaia bogorensis*
Pseudomonadota	Acetobacteraceae	*Asaia*	*Asaia krungthepensis*
Pseudomonadota	Acetobacteraceae	*Asaia*	*Asaia lannensis*
Pseudomonadota	Acetobacteraceae	*Asaia*	*Asaia platycodi*
Pseudomonadota	Acetobacteraceae	*Asaia*	*Asaia prunellae*
Pseudomonadota	Acetobacteraceae	*Asaia*	*Asaia siamensis*
Pseudomonadota	Acetobacteraceae	*Asaia*	*Asaia spathodeae*
Pseudomonadota	Enterobacteriaceae	*Atlantibacter*	*Atlantibacter hermannii*
Pseudomonadota	Enterobacteriaceae	*Atlantibacter*	*Atlantibacter subterranea*
Pseudomonadota	Pseudohongiellaceae	*Atopomonas*	*Atopomonas hussainii*
Pseudomonadota	Rhizobiaceae	*Aurantimonas*	*Aurantimonas endophytica*

Pseudomonadota	Pasteurellaceae	*Avibacterium*	*Avibacterium avium*
Pseudomonadota	Pasteurellaceae	*Avibacterium*	*Avibacterium gallinarum*
Pseudomonadota	Pasteurellaceae	*Avibacterium*	*Avibacterium paragallinarum*
Pseudomonadota	Pasteurellaceae	*Avibacterium*	*Avibacterium volantium*
Pseudomonadota	Rhodocyclaceae	*Azoarcus*	*Azoarcus anaerobius*
Pseudomonadota	Rhodocyclaceae	*Azoarcus*	*Azoarcus evansii*
Pseudomonadota	Rhodocyclaceae	*Azoarcus*	*Azoarcus indigens*
Pseudomonadota	Rhodocyclaceae	*Azoarcus*	*Azoarcus toluclasticus*
Pseudomonadota	Pseudomonadaceae	*Azomonas*	*Azomonas agilis*
Pseudomonadota	Xanthobacteraceae	*Azorhizobium*	*Azorhizobium caulinodans*
Pseudomonadota	Xanthobacteraceae	*Azorhizobium*	*Azorhizobium doebereinerae*
Pseudomonadota	Xanthobacteraceae	*Azorhizobium*	*Azorhizobium oxalatiphilum*
Pseudomonadota	Pseudohongiellaceae	*Azorhizophilus*	*Azorhizophilus paspali*
Pseudomonadota	Azospirillaceae	*Azospirillum*	*Azospirillum thermophilum*
Pseudomonadota	Pseudomonadaceae	*Azotobacter*	*Azotobacter nigricans*
Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella ancashensis*
Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella apis*
Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella australis*
Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella bacilliformis*
Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella birtlesii*
Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella capreoli*
Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella chomelii*

Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella coopersplainsensis*
Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella elizabethae*
Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella fuyuanensis*
Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella henselae*
Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella koehlerae*
Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella pachyuromydis*
Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella phoceensis*
Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella queenslandensis*
Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella quintana*
Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella rattaustraliani*
Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella rattimassiliensis*
Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella rochalimae*
Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella taylorii*
Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella tribocorum*
Pseudomonadota	Rhizobiaceae	*Bartonella*	*Bartonella vinsonii*
Pseudomonadota	Pasteurellaceae	*Basfia*	*Basfia succiniciproducens*
Pseudomonadota	Kaistiaceae	*Bauldia*	*Bauldia litoralis*
Pseudomonadota	Beijerinckiaceae	*Beijerinckia*	*Beijerinckia doebereinerae*
Pseudomonadota	Beijerinckiaceae	*Beijerinckia*	*Beijerinckia fluminensis*
Pseudomonadota	Beijerinckiaceae	*Beijerinckia*	*Beijerinckia indica*
Pseudomonadota	Beijerinckiaceae	*Beijerinckia*	*Beijerinckia mobilis*
Pseudomonadota	Neisseriaceae	*Bergeriella*	*Bergeriella denitrificans*

Pseudomonadota	Enterobacteriaceae	*Biostraticola*	*Biostraticola tofi*
Pseudomonadota	Pasteurellaceae	*Bisgaardia*	*Bisgaardia hudsonensis*
Pseudomonadota	Burkholderiaceae	*Bordetella*	*Bordetella avium*
Pseudomonadota	Burkholderiaceae	*Bordetella*	*Bordetella trematum*
Pseudomonadota	Beijerinckiaceae	*Bosea*	*Bosea massiliensis*
Pseudomonadota	Beijerinckiaceae	*Bosea*	*Bosea minatitlanensis*
Pseudomonadota	Beijerinckiaceae	*Bosea*	*Bosea robiniae*
Pseudomonadota	Beijerinckiaceae	*Bosea*	*Bosea thiooxidans*
Pseudomonadota	Beijerinckiaceae	*Bosea*	*Bosea vestrisii*
Pseudomonadota	Alteromonadaceae	*Bowmanella*	*Bowmanella denitrificans*
Pseudomonadota	Alteromonadaceae	*Bowmanella*	*Bowmanella pacifica*
Pseudomonadota	Burkholderiaceae	*Brackiella*	*Brackiella oedipodis*
Pseudomonadota	Xanthobacteraceae	*Bradyrhizobium*	*Bradyrhizobium americanum*
Pseudomonadota	Xanthobacteraceae	*Bradyrhizobium*	*Bradyrhizobium cajani*
Pseudomonadota	Xanthobacteraceae	*Bradyrhizobium*	*Bradyrhizobium centrosematis*
Pseudomonadota	Xanthobacteraceae	*Bradyrhizobium*	*Bradyrhizobium diazoefficiens*
Pseudomonadota	Xanthobacteraceae	*Bradyrhizobium*	*Bradyrhizobium elkanii*
Pseudomonadota	Xanthobacteraceae	*Bradyrhizobium*	*Bradyrhizobium iriomotense*
Pseudomonadota	Xanthobacteraceae	*Bradyrhizobium*	*Bradyrhizobium japonicum*
Pseudomonadota	Xanthobacteraceae	*Bradyrhizobium*	*Bradyrhizobium jicamae*
Pseudomonadota	Xanthobacteraceae	*Bradyrhizobium*	*Bradyrhizobium liaoningense*
Pseudomonadota	Xanthobacteraceae	*Bradyrhizobium*	*Bradyrhizobium lupini*

Pseudomonadota	Xanthobacteraceae	*Bradyrhizobium*	*Bradyrhizobium oligotrophicum*
Pseudomonadota	Xanthobacteraceae	*Bradyrhizobium*	*Bradyrhizobium pachyrhizi*
Pseudomonadota	Xanthobacteraceae	*Bradyrhizobium*	*Bradyrhizobium rifense*
Pseudomonadota	Xanthobacteraceae	*Bradyrhizobium*	*Bradyrhizobium valentinum*
Pseudomonadota	Xanthobacteraceae	*Bradyrhizobium*	*Bradyrhizobium viridifuturi;Bradyrhizobium*
Pseudomonadota	Enterobacteriaceae	*Brenneria*	*Brenneria alni*
Pseudomonadota	Enterobacteriaceae	*Brenneria*	*Brenneria corticis*
Pseudomonadota	Enterobacteriaceae	*Brenneria*	*Brenneria goodwinii*
Pseudomonadota	Enterobacteriaceae	*Brenneria*	*Brenneria nigrifluens*
Pseudomonadota	Enterobacteriaceae	*Brenneria*	*Brenneria populi*
Pseudomonadota	Enterobacteriaceae	*Brenneria*	*Brenneria roseae*
Pseudomonadota	Enterobacteriaceae	*Brenneria*	*Brenneria rubrifaciens*
Pseudomonadota	Enterobacteriaceae	*Brenneria*	*Brenneria salicis*
Pseudomonadota	Caulobacteraceae	*Brevundimonas*	*Brevundimonas nasdae*
Pseudomonadota	Brucellaceae	*Brucella*	*Brucella anthropi*
Pseudomonadota	Brucellaceae	*Brucella*	*Brucella ciceri*
Pseudomonadota	Brucellaceae	*Brucella*	*Brucella endophytica*
Pseudomonadota	Brucellaceae	*Brucella*	*Brucella gallinifaecis*
Pseudomonadota	Brucellaceae	*Brucella*	*Brucella haematophila*
Pseudomonadota	Brucellaceae	*Brucella*	*Brucella inopinata*
Pseudomonadota	Brucellaceae	*Brucella*	*Brucella intermedia*
Pseudomonadota	Brucellaceae	*Brucella*	*Brucella lupini*

Pseudomonadota	Brucellaceae	*Brucella*	*Brucella microti*
Pseudomonadota	Brucellaceae	*Brucella*	*Brucella oryzae*
Pseudomonadota	Brucellaceae	*Brucella*	*Brucella papionis*
Pseudomonadota	Brucellaceae	*Brucella*	*Brucella pituitosa*
Pseudomonadota	Brucellaceae	*Brucella*	*Brucella pseudintermedia*
Pseudomonadota	Enterobacteriaceae	*Budvicia*	*Budvicia aquatica*
Pseudomonadota	Enterobacteriaceae	*Budvicia*	*Budvicia diplopodorum*
Pseudomonadota	Burkholderiaceae	*Burkholderia*	*Burkholderia pseudomultivorans*
Pseudomonadota	Burkholderiaceae	*Burkholderia*	*Burkholderia rinojensis*
Pseudomonadota	Burkholderiaceae	*Burkholderia*	*Burkholderia stabilis*
Pseudomonadota	Burkholderiaceae	*Burkholderia*	*Burkholderia thailandensis*
Pseudomonadota	Enterobacteriaceae	*Buttiauxella*	*Buttiauxella agrestis*
Pseudomonadota	Enterobacteriaceae	*Buttiauxella*	*Buttiauxella brennerae*
Pseudomonadota	Enterobacteriaceae	*Buttiauxella*	*Buttiauxella ferragutiae*
Pseudomonadota	Enterobacteriaceae	*Buttiauxella*	*Buttiauxella gaviniae*
Pseudomonadota	Enterobacteriaceae	*Buttiauxella*	*Buttiauxella izardii*
Pseudomonadota	Enterobacteriaceae	*Buttiauxella*	*Buttiauxella noackiae*
Pseudomonadota	Enterobacteriaceae	*Buttiauxella*	*Buttiauxella warmboldiae*
Pseudomonadota	Tepidamorphaceae	*Butyratibacter*	*Butyratibacter algicola*
Pseudomonadota	Burkholderiaceae	*Caballeronia*	*Caballeronia arationis*
Pseudomonadota	Burkholderiaceae	*Caballeronia*	*Caballeronia arvi*
Pseudomonadota	Burkholderiaceae	*Caballeronia*	*Caballeronia calidae*

Pseudomonadota	Burkholderiaceae	*Caballeronia*	*Caballeronia concitans*
Pseudomonadota	Burkholderiaceae	*Caballeronia*	*Caballeronia cordobensis*
Pseudomonadota	Burkholderiaceae	*Caballeronia*	*Caballeronia fortuita*
Pseudomonadota	Burkholderiaceae	*Caballeronia*	*Caballeronia grimmiae*
Pseudomonadota	Burkholderiaceae	*Caballeronia*	*Caballeronia jiangsuensis*
Pseudomonadota	Burkholderiaceae	*Caballeronia*	*Caballeronia megalochromosomata*
Pseudomonadota	Burkholderiaceae	*Caballeronia*	*Caballeronia pedi*
Pseudomonadota	Burkholderiaceae	*Caballeronia*	*Caballeronia ptereochthonis*
Pseudomonadota	Burkholderiaceae	*Caballeronia*	*Caballeronia temeraria*
Pseudomonadota	Burkholderiaceae	*Caballeronia*	*Caballeronia terrestris*
Pseudomonadota	Burkholderiaceae	*Caballeronia*	*Caballeronia turbans*
Pseudomonadota	Burkholderiaceae	*Caballeronia*	*Caballeronia zhejiangensis*
Pseudomonadota	Francisellaceae	*Caedibacter*	*Caedibacter taeniospiralis*
Pseudomonadota	Caedimonadaceae	*Caedimonas*	*Caedimonas varicaedens*
Pseudomonadota	Burkholderiaceae	*Caenibaculum*	*Caenibaculum baiyandianus*
Pseudomonadota	Rhodospirillaceae	*Caenispirillum*	*Caenispirillum bisanense*
Pseudomonadota	Rhodospirillaceae	*Caenispirillum*	*Caenispirillum deserti*
Pseudomonadota	Rhodospirillaceae	*Caenispirillum*	*Caenispirillum salinarum*
Pseudomonadota	Burkholderiaceae	*Caldimonas*	*Caldimonas hydrothermale*
Pseudomonadota	Pasteurellaceae	*Canicola*	*Canicola haemoglobinophilus*
Pseudomonadota	Caulobacteraceae	*Caulobacter*	*Caulobacter hibisci*
Pseudomonadota	Caulobacteraceae	*Caulobacter*	*Caulobacter mirabilis*

Pseudomonadota	Caulobacteraceae	*Caulobacter*	*Caulobacter vibrioides*
Pseudomonadota	Moraxellaceae	*Cavicella*	*Cavicella subterranea*
Pseudomonadota	Pasteurellaceae	*Caviibacterium*	*Caviibacterium pharyngocola*
Pseudomonadota	Enterobacteriaceae	*Cedecea*	*Cedecea davisae*
Pseudomonadota	Enterobacteriaceae	*Cedecea*	*Cedecea lapagei*
Pseudomonadota	Enterobacteriaceae	*Cedecea*	*Cedecea neteri*
Pseudomonadota	Psychromonadaceae	*Celerinatantimonas*	*Celerinatantimonas diazotrophica*
Pseudomonadota	Cellvibrionaceae	*Cellvibrio*	*Cellvibrio fontiphilus*
Pseudomonadota	Enterobacteriaceae	*Chania*	*Chania multitudinisentens*
Pseudomonadota	Beijerinckiaceae	*Chelatococcus*	*Chelatococcus asaccharovorans*
Pseudomonadota	Beijerinckiaceae	*Chelatococcus*	*Chelatococcus caeni*
Pseudomonadota	Beijerinckiaceae	*Chelatococcus*	*Chelatococcus composti*
Pseudomonadota	Beijerinckiaceae	*Chelatococcus*	*Chelatococcus daeguensis*
Pseudomonadota	Beijerinckiaceae	*Chelatococcus*	*Chelatococcus reniformis*
Pseudomonadota	Methylocystaceae	*Chenggangzhangella*	*Chenggangzhangella methanolivorans*
Pseudomonadota	Chitinibacteraceae	*Chitinilyticum*	*Chitinilyticum litopenaei*
Pseudomonadota	Chromobacteriaceae	*Chromobacterium*	*Chromobacterium alkanivorans*
Pseudomonadota	Chromobacteriaceae	*Chromobacterium*	*Chromobacterium aquaticum*
Pseudomonadota	Chromobacteriaceae	*Chromobacterium*	*Chromobacterium haemolyticum*
Pseudomonadota	Pleomorphomonadaceae	*Chthonobacter*	*Chthonobacter albigriseus*
Pseudomonadota	Xanthomonadaceae	*Chujaibacter*	*Chujaibacter soli*
Pseudomonadota	Rhizobiaceae	*Ciceribacter*	*Ciceribacter thiooxidans*

Pseudomonadota	Enterobacteriaceae	*Citrobacter*	*Citrobacter amalonaticus*
Pseudomonadota	Enterobacteriaceae	*Citrobacter*	*Citrobacter braakii*
Pseudomonadota	Enterobacteriaceae	*Citrobacter*	*Citrobacter cronae*
Pseudomonadota	Enterobacteriaceae	*Citrobacter*	*Citrobacter europaeus*
Pseudomonadota	Enterobacteriaceae	*Citrobacter*	*Citrobacter farmeri*
Pseudomonadota	Enterobacteriaceae	*Citrobacter*	*Citrobacter freundii*
Pseudomonadota	Enterobacteriaceae	*Citrobacter*	*Citrobacter gillenii*
Pseudomonadota	Enterobacteriaceae	*Citrobacter*	*Citrobacter koseri*
Pseudomonadota	Enterobacteriaceae	*Citrobacter*	*Citrobacter murliniae*
Pseudomonadota	Enterobacteriaceae	*Citrobacter*	*Citrobacter rodentium*
Pseudomonadota	Enterobacteriaceae	*Citrobacter*	*Citrobacter sedlakii*
Pseudomonadota	Enterobacteriaceae	*Citrobacter*	*Citrobacter werkmanii*
Pseudomonadota	Enterobacteriaceae	*Citrobacter*	*Citrobacter youngae*
Pseudomonadota	Halomonadaceae	*Cobetia*	*Cobetia marina*
Pseudomonadota	Thiotrichaceae	*Cocleimonas*	*Cocleimonas flava*
Pseudomonadota	Thorselliaceae	*Coetzeea*	*Coetzeea brasiliensis*
Pseudomonadota	Colwelliaceae	*Cognaticolwellia*	*Cognaticolwellia beringensis*
Pseudomonadota	Alteromonadaceae	*Colwellia*	*Colwellia asteriadis*
Pseudomonadota	Alteromonadaceae	*Colwellia*	*Colwellia meonggei*
Pseudomonadota	Alteromonadaceae	*Colwellia*	*Colwellia piezophila*
Pseudomonadota	Alteromonadaceae	*Colwellia*	*Colwellia sediminilitoris*
Pseudomonadota	Burkholderiaceae	*Comamonas*	*Comamonas aquatica*

Pseudomonadota	Burkholderiaceae	*Comamonas*	*Comamonas badia*
Pseudomonadota	Burkholderiaceae	*Comamonas*	*Comamonas phosphati*
Pseudomonadota	Burkholderiaceae	*Comamonas*	*Comamonas terrae*
Pseudomonadota	Burkholderiaceae	*Comamonas*	*Comamonas terrigena*
Pseudomonadota	Burkholderiaceae	*Comamonas*	*Comamonas testosteroni*
Pseudomonadota	Acetobacteraceae	*Commensalibacter*	*Commensalibacter intestini*
Pseudomonadota	Pasteurellaceae	*Conservatibacter*	*Conservatibacter flavescens*
Pseudomonadota	Vibrionaceae	*Corallibacterium*	*Corallibacterium pacifica*
Pseudomonadota	Neiellaceae	*Corallincola*	*Corallincola luteus*
Pseudomonadota	Neiellaceae	*Corallincola*	*Corallincola platygyrae*
Pseudomonadota	Neiellaceae	*Corallincola*	*Corallincola spongiicola*
Pseudomonadota	Comamonadaceae	*Corticibacter*	*Corticibacter populi*
Pseudomonadota	Morganellaceae	*Cosenzaea*	*Cosenzaea myxofaciens*
Pseudomonadota	Coxiellaceae	*Coxiella*	*Coxiella burnetii*
Pseudomonadota	Enterobacteriaceae	*Cronobacter*	*Cronobacter condimenti*
Pseudomonadota	Enterobacteriaceae	*Cronobacter*	*Cronobacter dublinensis*
Pseudomonadota	Enterobacteriaceae	*Cronobacter*	*Cronobacter malonaticus*
Pseudomonadota	Enterobacteriaceae	*Cronobacter*	*Cronobacter muytjensii*
Pseudomonadota	Enterobacteriaceae	*Cronobacter*	*Cronobacter sakazakii*
Pseudomonadota	Enterobacteriaceae	*Cronobacter*	*Cronobacter turicensis*
Pseudomonadota	Enterobacteriaceae	*Cronobacter*	*Cronobacter universalis*
Pseudomonadota	Burkholderiaceae	*Cupriavidus*	*Cupriavidus metallidurans*

Pseudomonadota	Burkholderiaceae	*Cupriavidus*	*Cupriavidus oxalaticus*
Pseudomonadota	Burkholderiaceae	*Curvibacter*	*Curvibacter fontanus*
Pseudomonadota	Cycloclasticaceae	*Cycloclasticus*	*Cycloclasticus pugetii*
Pseudomonadota	Fastidiosibacteraceae	*Cysteiniphilum*	*Cysteiniphilum litorale*
Pseudomonadota	Comamonadaceae	*Delftia*	*Delftia tsuruhatensis*
Pseudomonadota	Burkholderiaceae	*Derxia*	*Derxia gummosa*
Pseudomonadota	Devosiaceae	*Devosia*	*Devosia chinhatensis*
Pseudomonadota	Devosiaceae	*Devosia*	*Devosia enhydra*
Pseudomonadota	Devosiaceae	*Devosia*	*Devosia insulae*
Pseudomonadota	Devosiaceae	*Devosia*	*Devosia limi*
Pseudomonadota	Devosiaceae	*Devosia*	*Devosia mishustinii*
Pseudomonadota	Devosiaceae	*Devosia*	*Devosia riboflavina*
Pseudomonadota	Devosiaceae	*Devosia*	*Devosia soli*
Pseudomonadota	Devosiaceae	*Devosia*	*Devosia submarina*
Pseudomonadota	Cardiobacteriaceae	*Dichelobacter*	*Dichelobacter nodosus*
Pseudomonadota	Enterobacteriaceae	*Dickeya*	*Dickeya aquatica*
Pseudomonadota	Enterobacteriaceae	*Dickeya*	*Dickeya chrysanthemi*
Pseudomonadota	Enterobacteriaceae	*Dickeya*	*Dickeya dadantii*
Pseudomonadota	Enterobacteriaceae	*Dickeya*	*Dickeya dianthicola*
Pseudomonadota	Enterobacteriaceae	*Dickeya*	*Dickeya fangzhongdai*
Pseudomonadota	Enterobacteriaceae	*Dickeya*	*Dickeya paradisiaca*
Pseudomonadota	Enterobacteriaceae	*Dickeya*	*Dickeya zeae*

Pseudomonadota	Diplorickettsiaceae	*Diplorickettsia*	*Diplorickettsia massiliensis*
Pseudomonadota	Dissulfurirhabdaceae	*Dissulfurirhabdus*	*Dissulfurirhabdus thermomarina*
Pseudomonadota	Rhodanobacteraceae	*Dokdonella*	*Dokdonella kunshanensis*
Pseudomonadota	Rhodanobacteraceae	*Dokdonella*	*Dokdonella soli*
Pseudomonadota	Dongiaceae	*Dongia*	*Dongia mobilis*
Pseudomonadota	Dongiaceae	*Dongia*	*Dongia soli*
Pseudomonadota	Burkholderiaceae	*Duodenibacillus*	*Duodenibacillus massiliensis*
Pseudomonadota	Rhodanobacteraceae	*Dyella*	*Dyella caseinilytica*
Pseudomonadota	Rhodanobacteraceae	*Dyella*	*Dyella dinghuensis*
Pseudomonadota	Rhodanobacteraceae	*Dyella*	*Dyella jiangningensis*
Pseudomonadota	Rhodanobacteraceae	*Dyella*	*Dyella mobilis*
Pseudomonadota	Ectothiorhodospiraceae	*Ectothiorhodosinus*	*Ectothiorhodosinus mongolicus*
Pseudomonadota	Ectothiorhodospiraceae	*Ectothiorhodospira*	*Ectothiorhodospira haloalkaliphila*
Pseudomonadota	Ectothiorhodospiraceae	*Ectothiorhodospira*	*Ectothiorhodospira magna*
Pseudomonadota	Ectothiorhodospiraceae	*Ectothiorhodospira*	*Ectothiorhodospira variabilis*
Pseudomonadota	Enterobacteriaceae	*Edwardsiella*	*Edwardsiella anguillarum*
Pseudomonadota	Enterobacteriaceae	*Edwardsiella*	*Edwardsiella hoshinae*
Pseudomonadota	Enterobacteriaceae	*Edwardsiella*	*Edwardsiella ictaluri*
Pseudomonadota	Enterobacteriaceae	*Edwardsiella*	*Edwardsiella tarda*
Pseudomonadota	Anaplasmataceae	*Ehrlichia*	*Ehrlichia chaffeensis*
Pseudomonadota	Anaplasmataceae	*Ehrlichia*	*Ehrlichia rickettsia*
Pseudomonadota	Neisseriaceae	*Eikenella*	*Eikenella corrodens*

Pseudomonadota	Thioalkalispiraceae	*Endothiovibrio*	*Endothiovibrio diazotrophicus*
Pseudomonadota	Endozoicomonadaceae	*Endozoicomonas*	*Endozoicomonas ascidiicola*
Pseudomonadota	Rhizobiaceae	*Ensifer*	*Ensifer adhaerens*
Pseudomonadota	Enterobacteriaceae	*Enterobacillus*	*Enterobacillus tribolii*
Pseudomonadota	Enterobacteriaceae	*Enterobacter*	*Enterobacter asburiae*
Pseudomonadota	Enterobacteriaceae	*Enterobacter*	*Enterobacter bugandensis*
Pseudomonadota	Enterobacteriaceae	*Enterobacter*	*Enterobacter cancerogenus*
Pseudomonadota	Enterobacteriaceae	*Enterobacter*	*Enterobacter cloacae*
Pseudomonadota	Enterobacteriaceae	*Enterobacter*	*Enterobacter hormaechei*
Pseudomonadota	Enterobacteriaceae	*Enterobacter*	*Enterobacter kobei*
Pseudomonadota	Enterobacteriaceae	*Enterobacter*	*Enterobacter ludwigii*
Pseudomonadota	Enterobacteriaceae	*Enterobacter*	*Enterobacter mori*
Pseudomonadota	Enterobacteriaceae	*Enterobacter*	*Enterobacter soli*
Pseudomonadota	Enterobacteriaceae	*Enterobacter*	*Enterobacter tabaci*
Pseudomonadota	Vibrionaceae	*Enterovibrio*	*Enterovibrio nigricans*
Pseudomonadota	Vibrionaceae	*Enterovibrio*	*Enterovibrio norvegicus*
Pseudomonadota	Vibrionaceae	*Enterovibrio*	*Enterovibrio pacificus*
Pseudomonadota	Beijerinckiaceae	*Enterovirga*	*Enterovirga rhinocerotis*
Pseudomonadota	Pseudomonadaceae	*Entomomonas*	*Entomomonas moraniae*
Pseudomonadota	Enterobacteriaceae	*Erwinia*	*Erwinia amylovora*
Pseudomonadota	Enterobacteriaceae	*Erwinia*	*Erwinia aphidicola*
Pseudomonadota	Enterobacteriaceae	*Erwinia*	*Erwinia billingiae*

Pseudomonadota	Enterobacteriaceae	*Erwinia*	*Erwinia endophytica*
Pseudomonadota	Enterobacteriaceae	*Erwinia*	*Erwinia gerundensis*
Pseudomonadota	Enterobacteriaceae	*Erwinia*	*Erwinia iniecta*
Pseudomonadota	Enterobacteriaceae	*Erwinia*	*Erwinia mallotivora*
Pseudomonadota	Enterobacteriaceae	*Erwinia*	*Erwinia oleae*
Pseudomonadota	Enterobacteriaceae	*Erwinia*	*Erwinia papayae*
Pseudomonadota	Enterobacteriaceae	*Erwinia*	*Erwinia persiciErwinia*
Pseudomonadota	Enterobacteriaceae	*Erwinia*	*Erwinia persicina*
Pseudomonadota	Enterobacteriaceae	*Erwinia*	*Erwinia piriflorinigrans*
Pseudomonadota	Enterobacteriaceae	*Erwinia*	*Erwinia psidii*
Pseudomonadota	Enterobacteriaceae	*Erwinia*	*Erwinia pyrifoliae*
Pseudomonadota	Enterobacteriaceae	*Erwinia*	*Erwinia rhapontici*
Pseudomonadota	Enterobacteriaceae	*Erwinia*	*Erwinia tasmaniensis*
Pseudomonadota	Enterobacteriaceae	*Erwinia*	*Erwinia teleogrylli*
Pseudomonadota	Enterobacteriaceae	*Erwinia*	*Erwinia toletana*
Pseudomonadota	Enterobacteriaceae	*Erwinia*	*Erwinia tracheiphila*
Pseudomonadota	Enterobacteriaceae	*Erwinia*	*Erwinia typographi*
Pseudomonadota	Enterobacteriaceae	*Erwinia*	*Erwinia uzenensis*
Pseudomonadota	Sphingomonadaceae	*Erythrobacter*	*Erythrobacter lutimaris*
Pseudomonadota	Sphingomonadaceae	*Erythrobacter*	*Erythrobacter odishensis*
Pseudomonadota	Enterobacteriaceae	*Escherichia*	*Escherichia albertii*
Pseudomonadota	Enterobacteriaceae	*Escherichia*	*Escherichia coli*

Pseudomonadota	Enterobacteriaceae	*Escherichia*	*Escherichia fergusonii*
Pseudomonadota	Enterobacteriaceae	*Escherichia*	*Escherichia marmotae*
Pseudomonadota	Enterobacteriaceae	*Ewingella*	*Ewingella americana*
Pseudomonadota	Burkholderiaceae	*Extensimonas*	*Extensimonas perlucida*
Pseudomonadota	Francisellaceae	*Fangia*	*Fangia hongkongensis*
Pseudomonadota	Francisellaceae	*Fastidiosibacter*	*Fastidiosibacter lacustris*
Pseudomonadota	Shewanellaceae	*Ferrimonas*	*Ferrimonas balearica*
Pseudomonadota	Shewanellaceae	*Ferrimonas*	*Ferrimonas futtsuensis*
Pseudomonadota	Shewanellaceae	*Ferrimonas*	*Ferrimonas marina*
Pseudomonadota	Shewanellaceae	*Ferrimonas*	*Ferrimonas pelagia*
Pseudomonadota	Hyphomicrobiaceae	*Filomicrobium*	*Filomicrobium insigne*
Pseudomonadota	Fluviibactteraceae	*Fluviibacter*	*Fluviibacter phosphoraccumulans*
Pseudomonadota	Francisellaceae	*Francisella*	*Francisella persica*
Pseudomonadota	Enterobacteriaceae	*Franconibacter*	*Franconibacter daqui*
Pseudomonadota	Enterobacteriaceae	*Franconibacter*	*Franconibacter helveticus*
Pseudomonadota	Enterobacteriaceae	*Franconibacter*	*Franconibacter pulveris*
Pseudomonadota	Rhodanobacteraceae	*Frateuria*	*Frateuria aurantia*
Pseudomonadota	Pasteurellaceae	*Frederiksenia*	*Frederiksenia canicola*
Pseudomonadota	Enterobacteriaceae	*Frischella*	*Frischella perrara*
Pseudomonadota	Gallaecimonadaceae	*Gallaecimonas*	*Gallaecimonas pentaromativorans*
Pseudomonadota	Gallaecimonadaceae	*Gallaecimonas*	*Gallaecimonas xiamenensis*
Pseudomonadota	Pasteurellaceae	*Gallibacterium*	*Gallibacterium salpingitidis*

Pseudomonadota	Pasteurellaceae	*Gallibacterium*	*Gallibacterium trehalosifermentans*
Pseudomonadota	Gallionellaceae	*Gallionella*	*Gallionella capsiferriformans*
Pseudomonadota	Rhodobacteraceae	*Gemmobacter*	*Gemmobacter aquatilis*
Pseudomonadota	Sterolibacteriaceae	*Georgfuchsia*	*Georgfuchsia toluolica*
Pseudomonadota	Enterobacteriaceae	*Gibbsiella*	*Gibbsiella dentisursi*
Pseudomonadota	Enterobacteriaceae	*Gibbsiella*	*Gibbsiella greigii*
Pseudomonadota	Enterobacteriaceae	*Gibbsiella*	*Gibbsiella quercinecans*
Pseudomonadota	Enterobacteriaceae	*Gilliamella*	*Gilliamella apicola*
Pseudomonadota	Enterobacteriaceae	*Gilliamella*	*Gilliamella bombi*
Pseudomonadota	Enterobacteriaceae	*Gilliamella*	*Gilliamella bombicola*
Pseudomonadota	Enterobacteriaceae	*Gilliamella*	*Gilliamella intestini*
Pseudomonadota	Enterobacteriaceae	*Gilliamella*	*Gilliamella mensalis*
Pseudomonadota	Pasteurellaceae	*Glaesserella*	*Glaesserella parasuis*
Pseudomonadota	Acetobacteraceae	*Gluconacetobacter*	*Gluconacetobacter johannae*
Pseudomonadota	Acetobacteraceae	*Gluconacetobacter*	*Gluconacetobacter liquefaciens*
Pseudomonadota	Acetobacteraceae	*Gluconacetobacter*	*Gluconacetobacter sacchari*
Pseudomonadota	Acetobacteraceae	*Gluconacetobacter*	*Gluconacetobacter takamatsuzukensis*
Pseudomonadota	Acetobacteraceae	*Gluconobacter*	*Gluconobacter cerevisiae*
Pseudomonadota	Acetobacteraceae	*Gluconobacter*	*Gluconobacter cerinus*
Pseudomonadota	Acetobacteraceae	*Gluconobacter*	*Gluconobacter frateurii*
Pseudomonadota	Acetobacteraceae	*Gluconobacter*	*Gluconobacter japonicus*
Pseudomonadota	Acetobacteraceae	*Gluconobacter*	*Gluconobacter kanchanaburiensis*

Pseudomonadota	Acetobacteraceae	*Gluconobacter*	*Gluconobacter kondonii*
Pseudomonadota	Acetobacteraceae	*Gluconobacter*	*Gluconobacter oxydans*
Pseudomonadota	Acetobacteraceae	*Gluconobacter*	*Gluconobacter sphaericus*
Pseudomonadota	Acetobacteraceae	*Gluconobacter*	*Gluconobacter thailandicus*
Pseudomonadota	Acetobacteraceae	*Gluconobacter*	*Gluconobacter wancherniae*
Pseudomonadota	Maricaulaceae	*Glycocaulis*	*Glycocaulis albus*
Pseudomonadota	Granulosicoccaceae	*Granulosicoccus*	*Granulosicoccus antarcticus*
Pseudomonadota	Granulosicoccaceae	*Granulosicoccus*	*Granulosicoccus coccoides*
Pseudomonadota	Vibrionaceae	*Grimontia*	*Grimontia celer*
Pseudomonadota	Vibrionaceae	*Grimontia*	*Grimontia hollisae*
Pseudomonadota	Vibrionaceae	*Grimontia*	*Grimontia marina*
Pseudomonadota	Rhodobacteraceae	*Haematobacter*	*Haematobacter massiliensis*
Pseudomonadota	Rhodobacteraceae	*Haematobacter*	*Haematobacter missouriensis*
Pseudomonadota	Pasteurellaceae	*Haemophilus*	*Haemophilus ducreyi*
Pseudomonadota	Pasteurellaceae	*Haemophilus*	*Haemophilus felis*
Pseudomonadota	Pasteurellaceae	*Haemophilus*	*Haemophilus haemoglobinophilus*
Pseudomonadota	Pasteurellaceae	*Haemophilus*	*Haemophilus haemolyticus*
Pseudomonadota	Pasteurellaceae	*Haemophilus*	*Haemophilus influenzae*
Pseudomonadota	Pasteurellaceae	*Haemophilus*	*Haemophilus massiliensis*
Pseudomonadota	Pasteurellaceae	*Haemophilus*	*Haemophilus paracuniculus*
Pseudomonadota	Pasteurellaceae	*Haemophilus*	*Haemophilus parahaemolyticus*
Pseudomonadota	Pasteurellaceae	*Haemophilus*	*Haemophilus parainfluenzae*

Pseudomonadota	Pasteurellaceae	*Haemophilus*	*Haemophilus paraphrohaemolyticus*
Pseudomonadota	Pasteurellaceae	*Haemophilus*	*Haemophilus piscium*
Pseudomonadota	Pasteurellaceae	*Haemophilus*	*Haemophilus pittmaniae*
Pseudomonadota	Pasteurellaceae	*Haemophilus*	*Haemophilus sputorum*
Pseudomonadota	Enterobacteriaceae	*Hafnia*	*Hafnia alvei*
Pseudomonadota	Enterobacteriaceae	*Hafnia*	*Hafnia paralvei*
Pseudomonadota	Enterobacteriaceae	*Hafnia*	*Hafnia psychrotolerans*
Pseudomonadota	Oleiphilaceae	*Hahella*	*Hahella ganghwensis*
Pseudomonadota	Halieaceae	*Haliea*	*Haliea salexigens*
Pseudomonadota	Halomonadaceae	*Halomonas*	*Halomonas flava*
Pseudomonadota	Halomonadaceae	*Halomonas*	*Halomonas meridiana*
Pseudomonadota	Halomonadaceae	*Halomonas*	*Halomonas pacifica*
Pseudomonadota	Halomonadaceae	*Halomonas*	*Halomonas sabkhae*
Pseudomonadota	Halomonadaceae	*Halomonas*	*Halomonas titanicae*
Pseudomonadota	Pseudomonadaceae	*Halopseudomonas*	*Halopseudomonas bauzanensis*
Pseudomonadota	Pseudomonadaceae	*Halopseudomonas*	*Halopseudomonas oceani*
Pseudomonadota	Pseudomonadaceae	*Halopseudomonas*	*Halopseudomonas pachastrellae*
Pseudomonadota	Pseudomonadaceae	*Halopseudomonas*	*Halopseudomonas pertucinogena*
Pseudomonadota	Pseudomonadaceae	*Halopseudomonas*	*Halopseudomonas salina*
Pseudomonadota	Pseudomonadaceae	*Halopseudomonas*	*Halopseudomonas xiamenensis*
Pseudomonadota	Pseudomonadaceae	*Halopseudomonas*	*Halopseudomonas xinjiangensis*
Pseudomonadota	Burkholderiaceae	*Herbaspirillum*	*Herbaspirillum seropedicae*

Pseudomonadota	Burkholderiaceae	*Herminiimonas*	*Herminiimonas saxobsidens*
Pseudomonadota	Rhizobiaceae	*Hoeflea*	*Hoeflea marina*
Pseudomonadota	Burkholderiaceae	*Hydrogenophaga*	*Hydrogenophaga aquatica*
Pseudomonadota	Thiomicrospiraceae	*Hydrogenovibrio*	*Hydrogenovibrio kuenenii*
Pseudomonadota	Hyphomicrobiaceae	*Hyphomicrobium*	*Hyphomicrobium chloromethanicum*
Pseudomonadota	Hyphomicrobiaceae	*Hyphomicrobium*	*Hyphomicrobium denitrificans*
Pseudomonadota	Hyphomicrobiaceae	*Hyphomicrobium*	*Hyphomicrobium facile*
Pseudomonadota	Hyphomicrobiaceae	*Hyphomicrobium*	*Hyphomicrobium hollandicum*
Pseudomonadota	Hyphomicrobiaceae	*Hyphomicrobium*	*Hyphomicrobium methylovorum*
Pseudomonadota	Hyphomicrobiaceae	*Hyphomicrobium*	*Hyphomicrobium nitrativorans*
Pseudomonadota	Hyphomicrobiaceae	*Hyphomicrobium*	*Hyphomicrobium sulfonivorans*
Pseudomonadota	Hyphomicrobiaceae	*Hyphomicrobium*	*Hyphomicrobium vulgare*
Pseudomonadota	Hyphomicrobiaceae	*Hyphomicrobium*	*Hyphomicrobium zavarzinii*
Pseudomonadota	Alteromonadaceae	*Idiomarina*	*Idiomarina andamanensis*
Pseudomonadota	Alteromonadaceae	*Idiomarina*	*Idiomarina aquatica*
Pseudomonadota	Alteromonadaceae	*Idiomarina*	*Idiomarina baltica*
Pseudomonadota	Alteromonadaceae	*Idiomarina*	*Idiomarina loihiensis*
Pseudomonadota	Alteromonadaceae	*Idiomarina*	*Idiomarina piscisalsi*
Pseudomonadota	Alteromonadaceae	*Idiomarina*	*Idiomarina seosinensis*
Pseudomonadota	Alteromonadaceae	*Idiomarina*	*Idiomarina tyrosinivorans*
Pseudomonadota	Alteromonadaceae	*Idiomarina*	*Idiomarina xiamenensis*
Pseudomonadota	Immundisolibacteraceae	*Immundisolibacter*	*Immundisolibacter cernigliae*

Pseudomonadota	Chitinibacteraceae	*Iodobacter*	*Iodobacter arcticus*
Pseudomonadota	Enterobacteriaceae	*Izhakiella*	*Izhakiella australiensis*
Pseudomonadota	Enterobacteriaceae	*Izhakiella*	*Izhakiella capsodis*
Pseudomonadota	Kaistiaceae	*Kaistia*	*Kaistia adipata*
Pseudomonadota	Kaistiaceae	*Kaistia*	*Kaistia dalseonensis*
Pseudomonadota	Kaistiaceae	*Kaistia*	*Kaistia geumhonensis*
Pseudomonadota	Kangiellaceae	*Kangiella*	*Kangiella sediminilitoris*
Pseudomonadota	Kiloniellaceae	*Kiloniella*	*Kiloniella antarctica*
Pseudomonadota	Kiloniellaceae	*Kiloniella*	*Kiloniella majae*
Pseudomonadota	Neisseriaceae	*Kingella*	*Kingella negevensis*
Pseudomonadota	Enterobacteriaceae	*Klebsiella*	*Klebsiella aerogenes*
Pseudomonadota	Enterobacteriaceae	*Klebsiella*	*Klebsiella grimontii*
Pseudomonadota	Enterobacteriaceae	*Klebsiella*	*Klebsiella huaxiensis*
Pseudomonadota	Enterobacteriaceae	*Klebsiella*	*Klebsiella michiganensis*
Pseudomonadota	Enterobacteriaceae	*Klebsiella*	*Klebsiella oxytoca*
Pseudomonadota	Enterobacteriaceae	*Klebsiella*	*Klebsiella pneumoniae*
Pseudomonadota	Enterobacteriaceae	*Klebsiella*	*Klebsiella quasipneumoniae*
Pseudomonadota	Enterobacteriaceae	*Klebsiella*	*Klebsiella variicola*
Pseudomonadota	Enterobacteriaceae	*Kluyvera*	*Kluyvera ascorbata*
Pseudomonadota	Enterobacteriaceae	*Kluyvera*	*Kluyvera cryocrescens*
Pseudomonadota	Enterobacteriaceae	*Kluyvera*	*Kluyvera georgiaKluyvera*
Pseudomonadota	Enterobacteriaceae	*Kluyvera*	*Kluyvera georgiana*

Pseudomonadota	Enterobacteriaceae	*Kluyvera*	*Kluyvera intermedia*
Pseudomonadota	Acetobacteraceae	*Komagataeibacter*	*Komagataeibacter europaeus*
Pseudomonadota	Acetobacteraceae	*Komagataeibacter*	*Komagataeibacter intermedius*
Pseudomonadota	Acetobacteraceae	*Komagataeibacter*	*Komagataeibacter medellinensis*
Pseudomonadota	Acetobacteraceae	*Komagataeibacter*	*Komagataeibacter saccharivorans*
Pseudomonadota	Acetobacteraceae	*Komagataeibacter*	*Komagataeibacter sucrofermentans*
Pseudomonadota	Enterobacteriaceae	*Kosakonia*	*Kosakonia arachidis*
Pseudomonadota	Enterobacteriaceae	*Kosakonia*	*Kosakonia cowanii*
Pseudomonadota	Enterobacteriaceae	*Kosakonia*	*Kosakonia oryzae*
Pseudomonadota	Enterobacteriaceae	*Kosakonia*	*Kosakonia oryzendophytica*
Pseudomonadota	Enterobacteriaceae	*Kosakonia*	*Kosakonia oryziphila*
Pseudomonadota	Enterobacteriaceae	*Kosakonia*	*Kosakonia pseudosacchari*
Pseudomonadota	Enterobacteriaceae	*Kosakonia*	*Kosakonia quasisacchari*
Pseudomonadota	Enterobacteriaceae	*Kosakonia*	*Kosakonia radicincitans*
Pseudomonadota	Enterobacteriaceae	*Kosakonia*	*Kosakonia sacchari*
Pseudomonadota	Halomonadaceae	*Kushneria*	*Kushneria indalinina*
Pseudomonadota	Labraceae	*Labrys*	*Labrys miyagiensis*
Pseudomonadota	Labraceae	*Labrys*	*Labrys monachus*
Pseudomonadota	Labraceae	*Labrys*	*Labrys neptuniae*
Pseudomonadota	Labraceae	*Labrys*	*Labrys okinawensis*
Pseudomonadota	Labraceae	*Labrys*	*Labrys portucalensis*
Pseudomonadota	Labraceae	*Labrys*	*Labrys wisconsinensis*

Pseudomonadota	Chromatiaceae	*Lamprocystis*	*Lamprocystis purpurea*
Pseudomonadota	Burkholderiaceae	*Lampropedia*	*Lampropedia aestuarii*
Pseudomonadota	Burkholderiaceae	*Lampropedia*	*Lampropedia hyalina*
Pseudomonadota	Burkholderiaceae	*Lampropedia*	*Lampropedia puyangensis*
Pseudomonadota	Burkholderiaceae	*Lautropia*	*Lautropia mirabilis*
Pseudomonadota	Enterobacteriaceae	*Leclercia*	*Leclercia adecarboxylata*
Pseudomonadota	Legionellaceae	*Legionella*	*Legionella beliardensis*
Pseudomonadota	Legionellaceae	*Legionella*	*Legionella brunensis*
Pseudomonadota	Legionellaceae	*Legionella*	*Legionella busanensis*
Pseudomonadota	Legionellaceae	*Legionella*	*Legionella cincinnatiensis*
Pseudomonadota	Legionellaceae	*Legionella*	*Legionella drancourtii*
Pseudomonadota	Legionellaceae	*Legionella*	*Legionella dresdenensis*
Pseudomonadota	Legionellaceae	*Legionella*	*Legionella geestiana*
Pseudomonadota	Legionellaceae	*Legionella*	*Legionella gresilensis*
Pseudomonadota	Legionellaceae	*Legionella*	*Legionella lansingensis*
Pseudomonadota	Legionellaceae	*Legionella*	*Legionella longbeachae*
Pseudomonadota	Legionellaceae	*Legionella*	*Legionella pneumophila*
Pseudomonadota	Legionellaceae	*Legionella*	*Legionella qingyii*
Pseudomonadota	Legionellaceae	*Legionella*	*Legionella rowbothamii*
Pseudomonadota	Legionellaceae	*Legionella*	*Legionella sainthelensi*
Pseudomonadota	Legionellaceae	*Legionella*	*Legionella saoudiensis*
Pseudomonadota	Legionellaceae	*Legionella*	*Legionella shakespearei*

Pseudomonadota	Legionellaceae	*Legionella*	*Legionella taurinensis*
Pseudomonadota	Legionellaceae	*Legionella*	*Legionella tunisiensis*
Pseudomonadota	Enterobacteriaceae	*Lelliottia*	*Lelliottia amnigena*
Pseudomonadota	Enterobacteriaceae	*Lelliottia*	*Lelliottia nimipressuralis*
Pseudomonadota	Enterobacteriaceae	*Leminorella*	*Leminorella grimontii*
Pseudomonadota	Phyllobacteriaceae	*Lentilitoribacter*	*Lentilitoribacter donghaensis*
Pseudomonadota	Burkholderiaceae	*Leptothrix*	*Leptothrix mobilis*
Pseudomonadota	Rhizobiaceae	*Liberibacter*	*Liberibacter crescens*
Pseudomonadota	Lichenibacteriaceae	*Lichenibacterium*	*Lichenibacterium ramalinae*
Pseudomonadota	Rhodovibrionaceae	*Limibacillus*	*Limibacillus halophilus*
Pseudomonadota	Burkholderiaceae	*Limnobacter*	*Limnobacter humi*
Pseudomonadota	Oceanospirillaceae	*Litoribacillus*	*Litoribacillus peritrichatus*
Pseudomonadota	Alteromonadaceae	*Litorilituus*	*Litorilituus lipolyticus*
Pseudomonadota	Pasteurellaceae	*Lonepinella*	*Lonepinella koalarum*
Pseudomonadota	Enterobacteriaceae	*Lonsdalea*	*Lonsdalea britannica*
Pseudomonadota	Enterobacteriaceae	*Lonsdalea*	*Lonsdalea iberica*
Pseudomonadota	Enterobacteriaceae	*Lonsdalea*	*Lonsdalea populi*
Pseudomonadota	Enterobacteriaceae	*Lonsdalea*	*Lonsdalea quercina*
Pseudomonadota	Rhodanobacteraceae	*Luteibacter*	*Luteibacter yeojuensis*
Pseudomonadota	Xanthomonadaceae	*Luteimonas*	*Luteimonas abyssi*
Pseudomonadota	Xanthomonadaceae	*Luteimonas*	*Luteimonas aquatica*
Pseudomonadota	Xanthomonadaceae	*Luteimonas*	*Luteimonas chenhongjianii*

Pseudomonadota	Xanthomonadaceae	*Luteimonas*	*Luteimonas huabeiensis*
Pseudomonadota	Tepidamorphaceae	*Lutibaculum*	*Lutibaculum baratangense*
Pseudomonadota	Xanthomonadaceae	*Lysobacter*	*Lysobacter brunescens*
Pseudomonadota	Xanthomonadaceae	*Lysobacter*	*Lysobacter concretionis*
Pseudomonadota	Xanthomonadaceae	*Lysobacter*	*Lysobacter firmicutimachus*
Pseudomonadota	Xanthomonadaceae	*Lysobacter*	*Lysobacter tyrosinelyticus*
Pseudomonadota	Magnetospiraceae	*Magnetospira*	*Magnetospira thiophila*
Pseudomonadota	Magnetospirillaceae	*Magnetospirillum*	*Magnetospirillum bellicus*
Pseudomonadota	Magnetovibrionaceae	*Magnetovibrio*	*Magnetovibrio blakemorei*
Pseudomonadota	Burkholderiaceae	*Malikia*	*Malikia granosa*
Pseudomonadota	Enterobacteriaceae	*Mangrovibacter*	*Mangrovibacter phragmitis*
Pseudomonadota	Enterobacteriaceae	*Mangrovibacter*	*Mangrovibacter plantisponsor*
Pseudomonadota	Enterobacteriaceae	*Mangrovibacter*	*Mangrovibacter yixingensis*
Pseudomonadota	Oleiphilaceae	*Mangrovitalea*	*Mangrovitalea sediminis*
Pseudomonadota	Pasteurellaceae	*Mannheimia*	*Mannheimia glucosida*
Pseudomonadota	Pasteurellaceae	*Mannheimia*	*Mannheimia granulomatis*
Pseudomonadota	Pasteurellaceae	*Mannheimia*	*Mannheimia haemolytica*
Pseudomonadota	Pasteurellaceae	*Mannheimia*	*Mannheimia ruminalis*
Pseudomonadota	Pasteurellaceae	*Mannheimia*	*Mannheimia succiniciproducens*
Pseudomonadota	Pasteurellaceae	*Mannheimia*	*Mannheimia varigena*
Pseudomonadota	Roseobacteraceae	*Maribius*	*Maribius salinus*
Pseudomonadota	Chromatiaceae	*Marichromatium*	*Marichromatium purpuratum*

Pseudomonadota	Halieaceae	*Marimicrobium*	*Marimicrobium arenosum*
Pseudomonadota	Alteromonadaceae	*Marinifaba*	*Marinifaba aquimaris*
Pseudomonadota	Oleiphilaceae	*Marinobacter*	*Marinobacter excellens*
Pseudomonadota	Oleiphilaceae	*Marinobacter*	*Marinobacter gudaonensis*
Pseudomonadota	Oleiphilaceae	*Marinobacter*	*Marinobacter lutaoensis*
Pseudomonadota	Oleiphilaceae	*Marinobacter*	*Marinobacter nauticus*
Pseudomonadota	Oleiphilaceae	*Marinobacter*	*Marinobacter profundi*
Pseudomonadota	Oleiphilaceae	*Marinobacter*	*Marinobacter vinifirmus*
Pseudomonadota	Nitrincolaceae	*Marinobacterium*	*Marinobacterium nitratireducens*
Pseudomonadota	Nitrincolaceae	*Marinobacterium*	*Marinobacterium zhoushanense*
Pseudomonadota	Marinomonadaceae	*Marinomonas*	*Marinomonas aquimarina*
Pseudomonadota	Marinomonadaceae	*Marinomonas*	*Marinomonas epiphytica*
Pseudomonadota	Marinomonadaceae	*Marinomonas*	*Marinomonas mediterranea*
Pseudomonadota	Marinomonadaceae	*Marinomonas*	*Marinomonas ostreistagni*
Pseudomonadota	Marinomonadaceae	*Marinomonas*	*Marinomonas polaris*
Pseudomonadota	Marinomonadaceae	*Marinomonas*	*Marinomonas pontica*
Pseudomonadota	Marinomonadaceae	*Marinomonas*	*Marinomonas vaga*
Pseudomonadota	Rhodobacteraceae	*Marinosulfonomonas*	*Marinosulfonomonas methylotropha*
Pseudomonadota	Alteromonadaceae	*Marisediminitalea*	*Marisediminitalea mangrovi*
Pseudomonadota	Rhodospirillaceae	*Marispirillum*	*Marispirillum indicum*
Pseudomonadota	Burkholderiaceae	*Massilia*	*Massilia agri*
Pseudomonadota	Burkholderiaceae	*Massilia*	*Massilia albidiflava*

Pseudomonadota	Burkholderiaceae	*Massilia*	*Massilia phosphatilytica*
Pseudomonadota	Burkholderiaceae	*Massilia*	*Massilia pinisoli*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium abyssinicae*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium acaciae*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium albiziae*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium amorphae*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium australicum*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium carbonis*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium chacoense*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium ciceri*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium delmotii*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium denitrificans*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium erdmanii*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium hankyongi*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium helmanticense*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium huakuii*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium jarvisii*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium loti*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium mediterraneum*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium muleiense*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium norvegicum*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium oceanicum*

Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium olivaresii*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium opportunistum*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium plurifarium*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium septentrionale*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium shonense*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium soli*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium sophorae*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium tamadayense*
Pseudomonadota	Rhizobiaceae	*Mesorhizobium*	*Mesorhizobium tianshanense*
Pseudomonadota	Enterobacteriaceae	*Metakosakonia*	*Metakosakonia massiliensis*
Pseudomonadota	Methylomonadaceae	*Methylobacter*	*Methylobacter marinus*
Pseudomonadota	Methylomonadaceae	*Methylobacter*	*Methylobacter tundripaludum*
Pseudomonadota	Beijerinckiaceae	*Methylobacterium*	*Methylobacterium aerolatum*
Pseudomonadota	Beijerinckiaceae	*Methylobacterium*	*Methylobacterium aquaticum*
Pseudomonadota	Beijerinckiaceae	*Methylobacterium*	*Methylobacterium brachiatum*
Pseudomonadota	Beijerinckiaceae	*Methylobacterium*	*Methylobacterium brachythecii*
Pseudomonadota	Beijerinckiaceae	*Methylobacterium*	*Methylobacterium dankookense*
Pseudomonadota	Beijerinckiaceae	*Methylobacterium*	*Methylobacterium durans*
Pseudomonadota	Beijerinckiaceae	*Methylobacterium*	*Methylobacterium gnaphalii*
Pseudomonadota	Beijerinckiaceae	*Methylobacterium*	*Methylobacterium goesingense*
Pseudomonadota	Beijerinckiaceae	*Methylobacterium*	*Methylobacterium haplocladii*
Pseudomonadota	Beijerinckiaceae	*Methylobacterium*	*Methylobacterium hispanicum*

Pseudomonadota	Beijerinckiaceae	*Methylobacterium*	*Methylobacterium isbiliense*
Pseudomonadota	Beijerinckiaceae	*Methylobacterium*	*Methylobacterium komagatae*
Pseudomonadota	Beijerinckiaceae	*Methylobacterium*	*Methylobacterium longum*
Pseudomonadota	Beijerinckiaceae	*Methylobacterium*	*Methylobacterium mesophilicum*
Pseudomonadota	Beijerinckiaceae	*Methylobacterium*	*Methylobacterium nodulans*
Pseudomonadota	Beijerinckiaceae	*Methylobacterium*	*Methylobacterium organophilum*
Pseudomonadota	Beijerinckiaceae	*Methylobacterium*	*Methylobacterium oryzae*
Pseudomonadota	Beijerinckiaceae	*Methylobacterium*	*Methylobacterium persicinum*
Pseudomonadota	Beijerinckiaceae	*Methylobacterium*	*Methylobacterium radiotolerans*
Pseudomonadota	Beijerinckiaceae	*Methylobacterium*	*Methylobacterium soli*
Pseudomonadota	Beijerinckiaceae	*Methylobacterium*	*Methylobacterium tardum*
Pseudomonadota	Beijerinckiaceae	*Methylocapsa*	*Methylocapsa acidiphila*
Pseudomonadota	Methyloligellaceae	*Methyloceanibacter*	*Methyloceanibacter caenitepidi*
Pseudomonadota	Beijerinckiaceae	*Methylocella*	*Methylocella silvestris*
Pseudomonadota	Beijerinckiaceae	*Methylocella*	*Methylocella tundrae*
Pseudomonadota	Methylococcaceae	*Methylococcus*	*Methylococcus capsulatus*
Pseudomonadota	Methylococcaceae	*Methylococcus*	*Methylococcus thermophilus*
Pseudomonadota	Beijerinckiaceae	*Methylocystis*	*Methylocystis heyeri*
Pseudomonadota	Methylococcaceae	*Methylogaea*	*Methylogaea oryzae*
Pseudomonadota	Methylomonadaceae	*Methylomicrobium*	*Methylomicrobium alcaliphilum*
Pseudomonadota	Methylomonadaceae	*Methylomonas*	*Methylomonas koyamae*
Pseudomonadota	Methylomonadaceae	*Methylomonas*	*Methylomonas lenta*

Pseudomonadota	Methylomonadaceae	*Methylomonas*	*Methylomonas methanica*
Pseudomonadota	Methylomonadaceae	*Methylomonas*	*Methylomonas rubra*
Pseudomonadota	Methylococcaceae	*Methyloparacoccus*	*Methyloparacoccus murrellii*
Pseudomonadota	Methylophagaceae	*Methylophaga*	*Methylophaga aminisulfidivorans*
Pseudomonadota	Methylophagaceae	*Methylophaga*	*Methylophaga thalassica*
Pseudomonadota	Methylopilaceae	*Methylopila*	*Methylopila jiangsuensis*
Pseudomonadota	Methylopilaceae	*Methylopila*	*Methylopila oligotropha*
Pseudomonadota	Methylobacteriaceae	*Methylorubrum*	*Methylorubrum extorquens*
Pseudomonadota	Methylobacteriaceae	*Methylorubrum*	*Methylorubrum podarium*
Pseudomonadota	Methylobacteriaceae	*Methylorubrum*	*Methylorubrum populi*
Pseudomonadota	Methylobacteriaceae	*Methylorubrum*	*Methylorubrum salsuginis*
Pseudomonadota	Methylobacteriaceae	*Methylorubrum*	*Methylorubrum suomiense*
Pseudomonadota	Methylomonadaceae	*Methylosarcina*	*Methylosarcina quisquiliarum*
Pseudomonadota	Beijerinckiaceae	*Methylosinus*	*Methylosinus trichosporium*
Pseudomonadota	Methylococcaceae	*Methylosphaera*	*Methylosphaera hansonii*
Pseudomonadota	Methylococcaceae	*Methylotuvimicrobium*	*Methylotuvimicrobium alcaliphilum*
Pseudomonadota	Methylococcaceae	*Methylotuvimicrobium*	*Methylotuvimicrobium japanense*
Pseudomonadota	Methylococcaceae	*Methylotuvimicrobium*	*Methylotuvimicrobium kenyense*
Pseudomonadota	Rhodocyclaceae	*Methyloversatilis*	*Methyloversatilis discipulorum*
Pseudomonadota	Methylophilaceae	*Methylovorus*	*Methylovorus mays*
Pseudomonadota	Tepidamorphaceae	*Microbaculum*	*Microbaculum marinum*
Pseudomonadota	Cellvibrionaceae	*Microbulbifer*	*Microbulbifer arenaceous*

Pseudomonadota	Cellvibrionaceae	*Microbulbifer*	*Microbulbifer flavimaris*
Pseudomonadota	Cellvibrionaceae	*Microbulbifer*	*Microbulbifer halophilus*
Pseudomonadota	Cellvibrionaceae	*Microbulbifer*	*Microbulbifer salipaludis*
Pseudomonadota	Beijerinckiaceae	*Microvirga*	*Microvirga aerilata*
Pseudomonadota	Beijerinckiaceae	*Microvirga*	*Microvirga aerophila*
Pseudomonadota	Beijerinckiaceae	*Microvirga*	*Microvirga lotononidis*
Pseudomonadota	Beijerinckiaceae	*Microvirga*	*Microvirga lupini*
Pseudomonadota	Beijerinckiaceae	*Microvirga*	*Microvirga makkahensis*
Pseudomonadota	Beijerinckiaceae	*Microvirga*	*Microvirga massiliensis*
Pseudomonadota	Beijerinckiaceae	*Microvirga*	*Microvirga soli*
Pseudomonadota	Beijerinckiaceae	*Microvirga*	*Microvirga zambiensis*
Pseudomonadota	Aquaspirillaceae	*Microvirgula*	*Microvirgula aerodenitrificans*
Pseudomonadota	Burkholderiaceae	*Mitsuaria*	*Mitsuaria chitosanitabida*
Pseudomonadota	Enterobacteriaceae	*Mixta*	*Mixta calida*
Pseudomonadota	Enterobacteriaceae	*Mixta*	*Mixta gaviniae*
Pseudomonadota	Enterobacteriaceae	*Mixta*	*Mixta intestinalis*
Pseudomonadota	Enterobacteriaceae	*Mixta*	*Mixta tenebrionis*
Pseudomonadota	Enterobacteriaceae	*Mixta*	*Mixta theicola*
Pseudomonadota	Halomonadaceae	*Modicisalibacter*	*Modicisalibacter tunisiensis*
Pseudomonadota	Enterobacteriaceae	*Moellerella*	*Moellerella wisconsensis*
Pseudomonadota	Pleomorphomonadaceae	*Mongoliimonas*	*Mongoliimonas terrestris*
Pseudomonadota	Moraxellaceae	*Moraxella*	*Moraxella bovoculi*

Pseudomonadota	Moraxellaceae	*Moraxella*	*Moraxella catarrhalis*
Pseudomonadota	Moraxellaceae	*Moraxella*	*Moraxella lacunata*
Pseudomonadota	Moraxellaceae	*Moraxella*	*Moraxella nonliquefaciens*
Pseudomonadota	Moraxellaceae	*Moraxella*	*Moraxella osloensis*
Pseudomonadota	Moraxellaceae	*Moraxella*	*Moraxella porci*
Pseudomonadota	Enterobacteriaceae	*Morganella*	*Morganella morganii*
Pseudomonadota	Enterobacteriaceae	*Morganella*	*Morganella psychrotolerans*
Pseudomonadota	Psychromonadaceae	*Moritella*	*Moritella marina*
Pseudomonadota	Psychromonadaceae	*Moritella*	*Moritella viscosa*
Pseudomonadota	Psychromonadaceae	*Motilimonas*	*Motilimonas eburnea*
Pseudomonadota	Psychromonadaceae	*Motilimonas*	*Motilimonas pumilua*
Pseudomonadota	Pasteurellaceae	*Muribacter*	*Muribacter muris*
Pseudomonadota	Pectobacteriaceae	*Musicola*	*Musicola keenii*
Pseudomonadota	Pectobacteriaceae	*Musicola*	*Musicola paradisiaca*
Pseudomonadota	Rhizobiaceae	*Mycoplana*	*Mycoplana dimorpha*
Pseudomonadota	Rhizobiaceae	*Mycoplana*	*Mycoplana ramosa*
Pseudomonadota	Pasteurellaceae	*Necropsobacter*	*Necropsobacter rosorum*
Pseudomonadota	Neiellaceae	*Neiella*	*Neiella marina*
Pseudomonadota	Neisseriaceae	*Neisseria*	*Neisseria animaloris*
Pseudomonadota	Neisseriaceae	*Neisseria*	*Neisseria canis*
Pseudomonadota	Neisseriaceae	*Neisseria*	*Neisseria cinerea*
Pseudomonadota	Neisseriaceae	*Neisseria*	*Neisseria dumasiana*

Pseudomonadota	Neisseriaceae	*Neisseria*	*Neisseria perflava*
Pseudomonadota	Neisseriaceae	*Neisseria*	*Neisseria shayeganii*
Pseudomonadota	Neisseriaceae	*Neisseria*	*Neisseria sicca*
Pseudomonadota	Neisseriaceae	*Neisseria*	*Neisseria wadsworthii*
Pseudomonadota	Neisseriaceae	*Neisseria*	*Neisseria weaveri*
Pseudomonadota	Neisseriaceae	*Neisseria*	*Neisseria zalophi*
Pseudomonadota	Rhizobiaceae	*Neorhizobium*	*Neorhizobium galegae*
Pseudomonadota	Nitrincolaceae	*Neptunomonas*	*Neptunomonas acidivorans*
Pseudomonadota	Enterobacteriaceae	*Nissabacter*	*Nissabacter archeti*
Pseudomonadota	Nitrincolaceae	*Nitrincola*	*Nitrincola alkalilacustris*
Pseudomonadota	Nitrincolaceae	*Nitrincola*	*Nitrincola alkalisediminis*
Pseudomonadota	Nitrincolaceae	*Nitrincola*	*Nitrincola schmidtii*
Pseudomonadota	Xanthobacteraceae	*Nitrobacter*	*Nitrobacter vulgaris*
Pseudomonadota	Nitrococcaceae	*Nitrococcus*	*Nitrococcus mobilis*
Pseudomonadota	Zoogloeaceae	*Nitrogeniibacter*	*Nitrogeniibacter mangrovi*
Pseudomonadota	Nitrosococcaceae	*Nitrosococcus*	*Nitrosococcus halophilus*
Pseudomonadota	Nitrosomonadaceae	*Nitrosomonas*	*Nitrosomonas communis*
Pseudomonadota	Nitrosomonadaceae	*Nitrosospira*	*Nitrosospira multiformis*
Pseudomonadota	Azospirillaceae	*Niveispirillum*	*Niveispirillum irakense*
Pseudomonadota	Burkholderiaceae	*Noviherbaspirillum*	*Noviherbaspirillum aurantiacum*
Pseudomonadota	Burkholderiaceae	*Noviherbaspirillum*	*Noviherbaspirillum canariense*
Pseudomonadota	Burkholderiaceae	*Noviherbaspirillum*	*Noviherbaspirillum soli*

Pseudomonadota	Rhodospirillaceae	*Novispirillum*	*Novispirillum itersonii*
Pseudomonadota	Sphingomonadaceae	*Novosphingobium*	*Novosphingobium aquaticum*
Pseudomonadota	Sphingomonadaceae	*Novosphingobium*	*Novosphingobium aquiterrae*
Pseudomonadota	Sphingomonadaceae	*Novosphingobium*	*Novosphingobium capsulatum*
Pseudomonadota	Sphingomonadaceae	*Novosphingobium*	*Novosphingobium fuchskuhlense*
Pseudomonadota	Sphingomonadaceae	*Novosphingobium*	*Novosphingobium guangzhouense*
Pseudomonadota	Sphingomonadaceae	*Novosphingobium*	*Novosphingobium humi*
Pseudomonadota	Sphingomonadaceae	*Novosphingobium*	*Novosphingobium indicum*
Pseudomonadota	Sphingomonadaceae	*Novosphingobium*	*Novosphingobium lotistagni*
Pseudomonadota	Sphingomonadaceae	*Novosphingobium*	*Novosphingobium pokkalii*
Pseudomonadota	Sphingomonadaceae	*Novosphingobium*	*Novosphingobium rosa*
Pseudomonadota	Sphingomonadaceae	*Novosphingobium*	*Novosphingobium sediminis*
Pseudomonadota	Hafniaceae	*Obesumbacterium*	*Obesumbacterium proteus*
Pseudomonadota	Rickettsiaceae	*Occidentia*	*Occidentia massiliensis*
Pseudomonadota	Sneathiellaceae	*Oceanibacterium*	*Oceanibacterium hippocampi*
Pseudomonadota	Oceanibaculaceae	*Oceanibaculum*	*Oceanibaculum nanhaiense*
Pseudomonadota	Oceanibaculaceae	*Oceanibaculum*	*Oceanibaculum pacificum*
Pseudomonadota	Rhodobacteraceae	*Oceanicella*	*Oceanicella actignis*
Pseudomonadota	Aeromonadaceae	*Oceanimonas*	*Oceanimonas doudoroffii*
Pseudomonadota	Aeromonadaceae	*Oceanimonas*	*Oceanimonas smirnovii*
Pseudomonadota	Aeromonadaceae	*Oceanisphaera*	*Oceanisphaera arctica*
Pseudomonadota	Aeromonadaceae	*Oceanisphaera*	*Oceanisphaera donghaensis*

Pseudomonadota	Aeromonadaceae	*Oceanisphaera*	*Oceanisphaera litoralis*
Pseudomonadota	Aeromonadaceae	*Oceanisphaera*	*Oceanisphaera marina*
Pseudomonadota	Aeromonadaceae	*Oceanisphaera*	*Oceanisphaera ostreae*
Pseudomonadota	Aeromonadaceae	*Oceanisphaera*	*Oceanisphaera profunda*
Pseudomonadota	Aeromonadaceae	*Oceanisphaera*	*Oceanisphaera psychrotolerans*
Pseudomonadota	Halomonadaceae	*Oceanospirillum*	*Oceanospirillum maris*
Pseudomonadota	Rhizobiaceae	*Ochrobactrum*	*Ochrobactrum grignonense*
Pseudomonadota	Rhizobiaceae	*Ochrobactrum*	*Ochrobactrum haematophilum*
Pseudomonadota	Rhizobiaceae	*Ochrobactrum*	*Ochrobactrum pseudogrignonense*
Pseudomonadota	Rhizobiaceae	*Ochrobactrum*	*Ochrobactrum tritici*
Pseudomonadota	Nitrobacteraceae	*Oligotropha*	*Oligotropha carboxidovorans*
Pseudomonadota	Enterobacteriaceae	*Orbus*	*Orbus hercynius*
Pseudomonadota	Enterobacteriaceae	*Orbus*	*Orbus sasakiae*
Pseudomonadota	Rickettsiaceae	*Orientia*	*Orientia chuto*
Pseudomonadota	Burkholderiaceae	*Orrella*	*Orrella dioscoreae*
Pseudomonadota	Ostreibacteriaceae	*Ostreibacterium*	*Ostreibacterium oceani*
Pseudomonadota	Pasteurellaceae	*Otariodibacter*	*Otariodibacter oris*
Pseudomonadota	Oxalobacteraceae	*Oxalicibacterium*	*Oxalicibacterium flavum*
Pseudomonadota	Burkholderiaceae	*Oxalobacter*	*Oxalobacter formigenes*
Pseudomonadota	Burkholderiaceae	*Oxalobacter*	*Oxalobacter vibrioformis*
Pseudomonadota	Burkholderiaceae	*Paenalcaligenes*	*Paenalcaligenes hominis*
Pseudomonadota	Rhodobacteraceae	*Paenirhodobacter*	*Paenirhodobacter enshiensis*

Pseudomonadota	Chromobacteriaceae	*Paludibacterium*	*Paludibacterium paludis*
Pseudomonadota	Chromobacteriaceae	*Paludibacterium*	*Paludibacterium purpuratum*
Pseudomonadota	Burkholderiaceae	*Pandoraea*	*Pandoraea aquatica*
Pseudomonadota	Burkholderiaceae	*Pandoraea*	*Pandoraea capi*
Pseudomonadota	Enterobacteriaceae	*Pantoea*	*Pantoea agglomerans*
Pseudomonadota	Enterobacteriaceae	*Pantoea*	*Pantoea allii*
Pseudomonadota	Enterobacteriaceae	*Pantoea*	*Pantoea ananatis*
Pseudomonadota	Enterobacteriaceae	*Pantoea*	*Pantoea anthophila*
Pseudomonadota	Enterobacteriaceae	*Pantoea*	*Pantoea beijingensis*
Pseudomonadota	Enterobacteriaceae	*Pantoea*	*Pantoea brenneri*
Pseudomonadota	Enterobacteriaceae	*Pantoea*	*Pantoea cypripedii*
Pseudomonadota	Enterobacteriaceae	*Pantoea*	*Pantoea deleyi*
Pseudomonadota	Enterobacteriaceae	*Pantoea*	*Pantoea dispersa*
Pseudomonadota	Enterobacteriaceae	*Pantoea*	*Pantoea eucalypti*
Pseudomonadota	Enterobacteriaceae	*Pantoea*	*Pantoea eucrina*
Pseudomonadota	Enterobacteriaceae	*Pantoea*	*Pantoea rodasii*
Pseudomonadota	Enterobacteriaceae	*Pantoea*	*Pantoea rwandensis*
Pseudomonadota	Enterobacteriaceae	*Pantoea*	*Pantoea septica*
Pseudomonadota	Enterobacteriaceae	*Pantoea*	*Pantoea stewartii*
Pseudomonadota	Enterobacteriaceae	*Pantoea*	*Pantoea vagans*
Pseudomonadota	Enterobacteriaceae	*Pantoea*	*Pantoea wallisii*
Pseudomonadota	Burkholderiaceae	*Paraburkholderia*	*Paraburkholderia acidipaludis*

Pseudomonadota	Burkholderiaceae	*Paraburkholderia*	*Paraburkholderia azotifigens*
Pseudomonadota	Burkholderiaceae	*Paraburkholderia*	*Paraburkholderia bannensis*
Pseudomonadota	Burkholderiaceae	*Paraburkholderia*	*Paraburkholderia caffeinilytica*
Pseudomonadota	Burkholderiaceae	*Paraburkholderia*	*Paraburkholderia dipogonis*
Pseudomonadota	Burkholderiaceae	*Paraburkholderia*	*Paraburkholderia ginsengisoli*
Pseudomonadota	Burkholderiaceae	*Paraburkholderia*	*Paraburkholderia metalliresistens*
Pseudomonadota	Burkholderiaceae	*Paraburkholderia*	*Paraburkholderia oxyphila*
Pseudomonadota	Burkholderiaceae	*Paraburkholderia*	*Paraburkholderia phymatum*
Pseudomonadota	Burkholderiaceae	*Paraburkholderia*	*Paraburkholderia sacchari*
Pseudomonadota	Burkholderiaceae	*Paraburkholderia*	*Paraburkholderia solisilvae*
Pseudomonadota	Burkholderiaceae	*Paraburkholderia*	*Paraburkholderia unamae*
Pseudomonadota	Burkholderiaceae	*Paracandidimonas*	*Paracandidimonas soli*
Pseudomonadota	Rhodobacteraceae	*Paracoccus*	*Paracoccus alimentarius*
Pseudomonadota	Rhodobacteraceae	*Paracoccus*	*Paracoccus denitrificans*
Pseudomonadota	Rhodobacteraceae	*Paracoccus*	*Paracoccus homiensis*
Pseudomonadota	Rhodobacteraceae	*Paracoccus*	*Paracoccus huijuniae*
Pseudomonadota	Rhodobacteraceae	*Paracoccus*	*Paracoccus limosus*
Pseudomonadota	Rhodobacteraceae	*Paracoccus*	*Paracoccus lutimaris*
Pseudomonadota	Rhodobacteraceae	*Paracoccus*	*Paracoccus solventivorans*
Pseudomonadota	Shewanellaceae	*Paraferrimonas*	*Paraferrimonas haliotis*
Pseudomonadota	Shewanellaceae	*Paraferrimonas*	*Paraferrimonas sedimenticola*
Pseudomonadota	Alteromonadaceae	*Paraglaciecola*	*Paraglaciecola aestuariivivens*

Pseudomonadota	Alteromonadaceae	*Paraglaciecola*	*Paraglaciecola agarilytica*
Pseudomonadota	Alteromonadaceae	*Paraglaciecola*	*Paraglaciecola arctica*
Pseudomonadota	Alteromonadaceae	*Paraglaciecola*	*Paraglaciecola hydrolytica*
Pseudomonadota	Alteromonadaceae	*Paraglaciecola*	*Paraglaciecola mesophila*
Pseudomonadota	Alteromonadaceae	*Paraglaciecola*	*Paraglaciecola oceanifecundans*
Pseudomonadota	Moritellaceae	*Paramoritella*	*Paramoritella alkaliphila*
Pseudomonadota	Vibrionaceae	*Paraphotobacterium*	*Paraphotobacterium marinum*
Pseudomonadota	Alcaligenaceae	*Parapusillimonas*	*Parapusillimonas granuli*
Pseudomonadota	Alteromonadaceae	*Pararheinheimera*	*Pararheinheimera aquatica*
Pseudomonadota	Alteromonadaceae	*Pararheinheimera*	*Pararheinheimera mesophila*
Pseudomonadota	Alteromonadaceae	*Pararheinheimera*	*Pararheinheimera texasensis*
Pseudomonadota	Shewanellaceae	*Parashewanella*	*Parashewanella spongiae*
Pseudomonadota	Endozoicomonadaceae	*Parendozoicomonas*	*Parendozoicomonas haliclonae*
Pseudomonadota	Pasteurellaceae	*Pasteurella*	*Pasteurella aerogenes*
Pseudomonadota	Pasteurellaceae	*Pasteurella*	*Pasteurella bettyae*
Pseudomonadota	Pasteurellaceae	*Pasteurella*	*Pasteurella canis*
Pseudomonadota	Pasteurellaceae	*Pasteurella*	*Pasteurella dagmatis*
Pseudomonadota	Pasteurellaceae	*Pasteurella*	*Pasteurella langaaensis*
Pseudomonadota	Pasteurellaceae	*Pasteurella*	*Pasteurella mairii*
Pseudomonadota	Pasteurellaceae	*Pasteurella*	*Pasteurella multocida*
Pseudomonadota	Pasteurellaceae	*Pasteurella*	*Pasteurella multocida;Pasteurella*
Pseudomonadota	Pasteurellaceae	*Pasteurella*	*Pasteurella oralis*

Pseudomonadota	Pasteurellaceae	*Pasteurella*	*Pasteurella skyensis*
Pseudomonadota	Pasteurellaceae	*Pasteurella*	*Pasteurella stomatis*
Pseudomonadota	Pasteurellaceae	*Pasteurella*	*Pasteurella testudinis*
Pseudomonadota	Enterobacteriaceae	*Pectobacterium*	*Pectobacterium actinidiae*
Pseudomonadota	Enterobacteriaceae	*Pectobacterium*	*Pectobacterium aroidearum*
Pseudomonadota	Enterobacteriaceae	*Pectobacterium*	*Pectobacterium atrosepticum*
Pseudomonadota	Enterobacteriaceae	*Pectobacterium*	*Pectobacterium betavasculorum*
Pseudomonadota	Enterobacteriaceae	*Pectobacterium*	*Pectobacterium brasiliense*
Pseudomonadota	Enterobacteriaceae	*Pectobacterium*	*Pectobacterium cacticida*
Pseudomonadota	Enterobacteriaceae	*Pectobacterium*	*Pectobacterium carotovorum*
Pseudomonadota	Enterobacteriaceae	*Pectobacterium*	*Pectobacterium odoriferum*
Pseudomonadota	Enterobacteriaceae	*Pectobacterium*	*Pectobacterium parmentieri*
Pseudomonadota	Enterobacteriaceae	*Pectobacterium*	*Pectobacterium polaris*
Pseudomonadota	Enterobacteriaceae	*Pectobacterium*	*Pectobacterium wasabiae*
Pseudomonadota	Hyphomicrobiaceae	*Pedomicrobium*	*Pedomicrobium americanum*
Pseudomonadota	Hyphomicrobiaceae	*Pedomicrobium*	*Pedomicrobium ferrugineum*
Pseudomonadota	Hyphomicrobiaceae	*Pedomicrobium*	*Pedomicrobium manganicum*
Pseudomonadota	Devosiaceae	*Pelagibacterium*	*Pelagibacterium halotolerans*
Pseudomonadota	Burkholderiaceae	*Pelistega*	*Pelistega indica*
Pseudomonadota	Burkholderiaceae	*Pelistega*	*Pelistega suis*
Pseudomonadota	Burkholderiaceae	*Pelomonas*	*Pelomonas saccharophila*
Pseudomonadota	Moraxellaceae	*Perlucidibaca*	*Perlucidibaca piscinae*

Pseudomonadota	Pseudomonadaceae	*Permianibacter*	*Permianibacter aggregans*
Pseudomonadota	Enterobacteriaceae	*Phaseolibacter*	*Phaseolibacter flectens*
Pseudomonadota	Pasteurellaceae	*Phocoenobacter*	*Phocoenobacter uteri*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium aestuarii*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium angustum*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium aphoticum*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium aplysiae*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium aquimaris*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium atrarenae*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium carnosum*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium chitinilyticum*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium damselae*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium frigidiphilum*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium gaetbulicola*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium galatheae*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium halotolerans*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium iliopiscarium*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium leiognathi*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium lipolyticum*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium panuliri*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium phosphoreum*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium piscicola*

Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium profundum*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium proteolyticum*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium rosenbergii*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium sanctipauli*
Pseudomonadota	Vibrionaceae	*Photobacterium*	*Photobacterium sanguinicancri*
Pseudomonadota	Enterobacteriaceae	*Photorhabdus*	*Photorhabdus akhurstii*
Pseudomonadota	Enterobacteriaceae	*Photorhabdus*	*Photorhabdus asymbiotica*
Pseudomonadota	Enterobacteriaceae	*Photorhabdus*	*Photorhabdus caribbeanensis*
Pseudomonadota	Enterobacteriaceae	*Photorhabdus*	*Photorhabdus kayaii*
Pseudomonadota	Enterobacteriaceae	*Photorhabdus*	*Photorhabdus khanii*
Pseudomonadota	Enterobacteriaceae	*Photorhabdus*	*Photorhabdus kleinii*
Pseudomonadota	Enterobacteriaceae	*Photorhabdus*	*Photorhabdus luminescens*
Pseudomonadota	Enterobacteriaceae	*Photorhabdus*	*Photorhabdus stackebrandtii*
Pseudomonadota	Enterobacteriaceae	*Photorhabdus*	*Photorhabdus temperata*
Pseudomonadota	Enterobacteriaceae	*Photorhabdus*	*Photorhabdus thracensis*
Pseudomonadota	Phreatobacteraceae	*Phreatobacter*	*Phreatobacter stygius*
Pseudomonadota	Rhizobiaceae	*Phyllobacterium*	*Phyllobacterium bourgognense*
Pseudomonadota	Rhizobiaceae	*Phyllobacterium*	*Phyllobacterium salinisoli*
Pseudomonadota	Enterobacteriaceae	*Phytobacter*	*Phytobacter diazotrophicus*
Pseudomonadota	Enterobacteriaceae	*Phytobacter*	*Phytobacter ursingii*
Pseudomonadota	Alteromonadaceae	*Planctobacterium*	*Planctobacterium marinum*
Pseudomonadota	Competibacteraceae	*Plasticicumulans*	*Plasticicumulans acidivorans*

Pseudomonadota	Competibacteraceae	*Plasticicumulans*	*Plasticicumulans lactativorans*
Pseudomonadota	Pleomorphomonadaceae	*Pleomorphomonas*	*Pleomorphomonas diazotrophica*
Pseudomonadota	Enterobacteriaceae	*Plesiomonas*	*Plesiomonas shigelloides*
Pseudomonadota	Enterobacteriaceae	*Pluralibacter*	*Pluralibacter gergoviae*
Pseudomonadota	Enterobacteriaceae	*Pluralibacter*	*Pluralibacter pyrinus*
Pseudomonadota	Burkholderiaceae	*Polynucleobacter*	*Polynucleobacter asymbioticus*
Pseudomonadota	Erythrobacteraceae	*Pontixanthobacter*	*Pontixanthobacter rizhaonensis*
Pseudomonadota	Enterobacteriaceae	*Pragia*	*Pragia fontium*
Pseudomonadota	Rhodocyclaceae	*Propionivibrio*	*Propionivibrio limicola*
Pseudomonadota	Enterobacteriaceae	*Proteus*	*Proteus cibarius*
Pseudomonadota	Enterobacteriaceae	*Proteus*	*Proteus hauseri*
Pseudomonadota	Enterobacteriaceae	*Proteus*	*Proteus mirabilis*
Pseudomonadota	Enterobacteriaceae	*Proteus*	*Proteus myxofaciens*
Pseudomonadota	Enterobacteriaceae	*Proteus*	*Proteus penneri*
Pseudomonadota	Enterobacteriaceae	*Proteus*	*Proteus terrae*
Pseudomonadota	Enterobacteriaceae	*Proteus*	*Proteus vulgaris*
Pseudomonadota	Enterobacteriaceae	*Providencia*	*Providencia alcalifaciens*
Pseudomonadota	Enterobacteriaceae	*Providencia*	*Providencia burhodogranariea*
Pseudomonadota	Enterobacteriaceae	*Providencia*	*Providencia heimbachae*
Pseudomonadota	Enterobacteriaceae	*Providencia*	*Providencia rettgeri*
Pseudomonadota	Enterobacteriaceae	*Providencia*	*Providencia rustigianii*
Pseudomonadota	Enterobacteriaceae	*Providencia*	*Providencia sneebia*

Pseudomonadota	Enterobacteriaceae	*Providencia*	*Providencia stuartii*
Pseudomonadota	Enterobacteriaceae	*Providencia*	*Providencia thailandensis*
Pseudomonadota	Enterobacteriaceae	*Providencia*	*Providencia vermicola*
Pseudomonadota	Enterobacteriaceae	*Pseudescherichia*	*Pseudescherichia vulneris*
Pseudomonadota	Idiomarinaceae	*Pseudidiomarina*	*Pseudidiomarina aquimaris*
Pseudomonadota	Idiomarinaceae	*Pseudidiomarina*	*Pseudidiomarina atlantica*
Pseudomonadota	Idiomarinaceae	*Pseudidiomarina*	*Pseudidiomarina donghaiensis*
Pseudomonadota	Idiomarinaceae	*Pseudidiomarina*	*Pseudidiomarina indica*
Pseudomonadota	Idiomarinaceae	*Pseudidiomarina*	*Pseudidiomarina maritima*
Pseudomonadota	Alteromonadaceae	*Pseudoalteromonas*	*Pseudoalteromonas aestuariivivens*
Pseudomonadota	Alteromonadaceae	*Pseudoalteromonas*	*Pseudoalteromonas arctica*
Pseudomonadota	Alteromonadaceae	*Pseudoalteromonas*	*Pseudoalteromonas carrageenovora*
Pseudomonadota	Alteromonadaceae	*Pseudoalteromonas*	*Pseudoalteromonas haloplanktis*
Pseudomonadota	Alteromonadaceae	*Pseudoalteromonas*	*Pseudoalteromonas lipolytica*
Pseudomonadota	Alteromonadaceae	*Pseudoalteromonas*	*Pseudoalteromonas luteoviolacea*
Pseudomonadota	Alteromonadaceae	*Pseudoalteromonas*	*Pseudoalteromonas nigrifaciens*
Pseudomonadota	Alteromonadaceae	*Pseudoalteromonas*	*Pseudoalteromonas prydzensis*
Pseudomonadota	Alteromonadaceae	*Pseudoalteromonas*	*Pseudoalteromonas ruthenica*
Pseudomonadota	Alteromonadaceae	*Pseudoalteromonas*	*Pseudoalteromonas shioyasakiensis*
Pseudomonadota	Alteromonadaceae	*Pseudoalteromonas*	*Pseudoalteromonas spongiae*
Pseudomonadota	Alteromonadaceae	*Pseudoalteromonas*	*Pseudoalteromonas xiamenensis*
Pseudomonadota	Alteromonadaceae	*Pseudobowmanella*	*Pseudobowmanella zhangzhouensis*

Pseudomonadota	Enterobacteriaceae	*Pseudocitrobacter*	*Pseudocitrobacter anthropi*
Pseudomonadota	Enterobacteriaceae	*Pseudocitrobacter*	*Pseudocitrobacter faecalis*
Pseudomonadota	Rhodobacteraceae	*Pseudogemmobacter*	*Pseudogemmobacter bohemicus*
Pseudomonadota	Pseudohongiellaceae	*Pseudohongiella*	*Pseudohongiella nitratireducens*
Pseudomonadota	Xanthobacteraceae	*Pseudolabrys*	*Pseudolabrys taiwanensis*
Pseudomonadota	Cellvibrionaceae	*Pseudomaricurvus*	*Pseudomaricurvus alcaniphilus*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas aeruginosa*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas aestus*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas alcaligenes*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas argentinensis*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas azotifigens*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas bohemica*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas borbori*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas cannabina*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas carboxydohydrogena*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas cedrina*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas chlororaphis*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas citronellolis*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas delhiensis*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas donghuensis*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas duriflava*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas entomophila*

Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas flavescens*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas flexibilis*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas fragi*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas frederiksbergensis*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas gessardii*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas glareae*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas guariconensis*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas helleri*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas helmanticensis*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas hussainii*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas indica*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas jinjuensis*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas knackmussii*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas kunmingensis*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas marincola*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas matsuisoli*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas migulae*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas monteilii*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas moraviensis*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas mosselii*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas mucidolens*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas multiresinivorans*

Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas nitritireducens*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas nitroreducens*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas oceani*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas oleovorans*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas oryzihabitans*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas otitidis*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas panacis*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas panipatensis*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas parafulva*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas peli*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas plecoglossicida*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas populi*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas psychrophila*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas punonensis*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas reidholzensis*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas reinekei*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas resinovorans*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas silesiensis*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas soli*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas taiwanensis*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas tarimensis*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas tolaasii*

Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas urumqiensis*
Pseudomonadota	Pseudomonadaceae	*Pseudomonas*	*Pseudomonas vranovensis*
Pseudomonadota	Rhizobiaceae	*Pseudorhizobium*	*Pseudorhizobium endolithicum*
Pseudomonadota	Xanthobacteraceae	*Pseudorhodoplanes*	*Pseudorhodoplanes sinuspersici*
Pseudomonadota	Cellvibrionaceae	*Pseudoteredinibacter*	*Pseudoteredinibacter isoporae*
Pseudomonadota	Stappiaceae	*Pseudovibrio*	*Pseudovibrio stylochi*
Pseudomonadota	Xanthomonadaceae	*Pseudoxanthomonas*	*Pseudoxanthomonas icgebensis*
Pseudomonadota	Xanthomonadaceae	*Pseudoxanthomonas*	*Pseudoxanthomonas japonensis*
Pseudomonadota	Xanthomonadaceae	*Pseudoxanthomonas*	*Pseudoxanthomonas suwonensis*
Pseudomonadota	Moraxellaceae	*Psychrobacter*	*Psychrobacter fulvigenes*
Pseudomonadota	Moraxellaceae	*Psychrobacter*	*Psychrobacter maritimus*
Pseudomonadota	Moraxellaceae	*Psychrobacter*	*Psychrobacter pacificensis*
Pseudomonadota	Moraxellaceae	*Psychrobacter*	*Psychrobacter pasteurii*
Pseudomonadota	Psychrobiaceae	*Psychrobium*	*Psychrobium conchae*
Pseudomonadota	Psychromonadaceae	*Psychromonas*	*Psychromonas aquatilis*
Pseudomonadota	Psychromonadaceae	*Psychromonas*	*Psychromonas heitensis*
Pseudomonadota	Psychromonadaceae	*Psychromonas*	*Psychromonas ingrahamii*
Pseudomonadota	Psychromonadaceae	*Psychromonas*	*Psychromonas macrocephali*
Pseudomonadota	Psychromonadaceae	*Psychromonas*	*Psychromonas profunda*
Pseudomonadota	Alteromonadaceae	*Psychrosphaera*	*Psychrosphaera aestuarii*
Pseudomonadota	Alteromonadaceae	*Psychrosphaera*	*Psychrosphaera aquimarina*
Pseudomonadota	Alteromonadaceae	*Psychrosphaera*	*Psychrosphaera saromensis*

Pseudomonadota	Burkholderiaceae	*Pusillimonas*	*Pusillimonas ginsengisoli*
Pseudomonadota	Burkholderiaceae	*Pusillimonas*	*Pusillimonas noertemannii*
Pseudomonadota	Burkholderiaceae	*Pusillimonas*	*Pusillimonas soli*
Pseudomonadota	Burkholderiaceae	*Pusillimonas*	*Pusillimonas thiosulfatoxidans*
Pseudomonadota	Enterobacteriaceae	*Rahnella*	*Rahnella aquatilis*
Pseudomonadota	Enterobacteriaceae	*Rahnella*	*Rahnella inusitata*
Pseudomonadota	Burkholderiaceae	*Ramlibacter*	*Ramlibacter solisilvae*
Pseudomonadota	Enterobacteriaceae	*Raoultella*	*Raoultella electrica*
Pseudomonadota	Enterobacteriaceae	*Raoultella*	*Raoultella ornithinolytica*
Pseudomonadota	Enterobacteriaceae	*Raoultella*	*Raoultella planticola*
Pseudomonadota	Enterobacteriaceae	*Raoultella*	*Raoultella terrigena*
Pseudomonadota	Reyranellaceae	*Reyranella*	*Reyranella graminifolii*
Pseudomonadota	Reyranellaceae	*Reyranella*	*Reyranella massiliensis*
Pseudomonadota	Reyranellaceae	*Reyranella*	*Reyranella soli*
Pseudomonadota	Reyranellaceae	*Reyranella*	*Reyranella terrae*
Pseudomonadota	Alteromonadaceae	*Rheinheimera*	*Rheinheimera aquimaris*
Pseudomonadota	Alteromonadaceae	*Rheinheimera*	*Rheinheimera hassiensis*
Pseudomonadota	Alteromonadaceae	*Rheinheimera*	*Rheinheimera pacifica*
Pseudomonadota	Alteromonadaceae	*Rheinheimera*	*Rheinheimera perlucida*
Pseudomonadota	Alteromonadaceae	*Rheinheimera*	*Rheinheimera riviphila*
Pseudomonadota	Alteromonadaceae	*Rheinheimera*	*Rheinheimera salexigens*
Pseudomonadota	Alteromonadaceae	*Rheinheimera*	*Rheinheimera sediminis*

Pseudomonadota	Alteromonadaceae	*Rheinheimera*	*Rheinheimera tuosuensis*
Pseudomonadota	Burkholderiaceae	*Rhizobacter*	*Rhizobacter dauci*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium acidisoli*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium aegyptiacum*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium aethiopicum*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium alamii*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium altiplani*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium azibense*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium capsici*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium cauense*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium cellulosilyticum*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium etli*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium gallicum*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium giardinii*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium halotolerans*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium jaguaris*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium kunmingense*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium leguminosarum*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium lusitanum*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium mesosinicum*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium naphthalenivorans*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium petrolearium*

Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium phaseoli*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium populi*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium pseudoryzae*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium tropici*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium undicola*
Pseudomonadota	Rhizobiaceae	*Rhizobium*	*Rhizobium viscosum*
Pseudomonadota	Micropepsaceae	*Rhizomicrobium*	*Rhizomicrobium palustre*
Pseudomonadota	Rhodanobacteraceae	*Rhodanobacter*	*Rhodanobacter denitrificans*
Pseudomonadota	Rhodanobacteraceae	*Rhodanobacter*	*Rhodanobacter terrae*
Pseudomonadota	Rhodanobacteraceae	*Rhodanobacter*	*Rhodanobacter umsongensis*
Pseudomonadota	Rhodobacteraceae	*Rhodobacter*	*Rhodobacter blasticus*
Pseudomonadota	Rhodobacteraceae	*Rhodobacter*	*Rhodobacter capsulatus*
Pseudomonadota	Rhodobacteraceae	*Rhodobacter*	*Rhodobacter sediminis*
Pseudomonadota	Beijerinckiaceae	*Rhodoblastus*	*Rhodoblastus acidophilus*
Pseudomonadota	Beijerinckiaceae	*Rhodoblastus*	*Rhodoblastus sphagnicola*
Pseudomonadota	Parvibaculaceae	*Rhodoligotrophos*	*Rhodoligotrophos appendicifer*
Pseudomonadota	Parvibaculaceae	*Rhodoligotrophos*	*Rhodoligotrophos jinshengii*
Pseudomonadota	Rhodomicrobiaceae	*Rhodomicrobium*	*Rhodomicrobium lacus*
Pseudomonadota	Rhodomicrobiaceae	*Rhodomicrobium*	*Rhodomicrobium vannielii*
Pseudomonadota	Acetobacteraceae	*Rhodopila*	*Rhodopila globiformis*
Pseudomonadota	Xanthobacteraceae	*Rhodoplanes*	*Rhodoplanes azumiensis*
Pseudomonadota	Xanthobacteraceae	*Rhodoplanes*	*Rhodoplanes piscinae*

Pseudomonadota	Xanthobacteraceae	*Rhodoplanes*	*Rhodoplanes roseus*
Pseudomonadota	Xanthobacteraceae	*Rhodoplanes*	*Rhodoplanes tepidicaeni*
Pseudomonadota	Xanthobacteraceae	*Rhodopseudomonas*	*Rhodopseudomonas boonkerdii*
Pseudomonadota	Xanthobacteraceae	*Rhodopseudomonas*	*Rhodopseudomonas faecalis*
Pseudomonadota	Acetobacteraceae	*Rhodovastum*	*Rhodovastum atsumiense*
Pseudomonadota	Rhodovibrionaceae	*Rhodovibrio*	*Rhodovibrio salinarum*
Pseudomonadota	Rickettsiaceae	*Rickettsia*	*Rickettsia bellii*
Pseudomonadota	Rickettsiaceae	*Rickettsia*	*Rickettsia conorii*
Pseudomonadota	Rickettsiaceae	*Rickettsia*	*Rickettsia honei*
Pseudomonadota	Rickettsiaceae	*Rickettsia*	*Rickettsia hulinii*
Pseudomonadota	Rickettsiaceae	*Rickettsia*	*Rickettsia parkeri*
Pseudomonadota	Burkholderiaceae	*Rivibacter*	*Rivibacter subsaxonicus*
Pseudomonadota	Pasteurellaceae	*Rodentibacter*	*Rodentibacter heylii*
Pseudomonadota	Pasteurellaceae	*Rodentibacter*	*Rodentibacter myodis*
Pseudomonadota	Pasteurellaceae	*Rodentibacter*	*Rodentibacter pneumotropicus*
Pseudomonadota	Pasteurellaceae	*Rodentibacter*	*Rodentibacter rarus*
Pseudomonadota	Pasteurellaceae	*Rodentibacter*	*Rodentibacter ratti*
Pseudomonadota	Beijerinckiaceae	*Roseiarcus*	*Roseiarcus fermentans*
Pseudomonadota	Acetobacteraceae	*Roseicella*	*Roseicella frigidaeris*
Pseudomonadota	Enterobacteriaceae	*Rosenbergiella*	*Rosenbergiella australiborealis*
Pseudomonadota	Enterobacteriaceae	*Rosenbergiella*	*Rosenbergiella collisarenosi*
Pseudomonadota	Enterobacteriaceae	*Rosenbergiella*	*Rosenbergiella epipactidis*

Pseudomonadota	Enterobacteriaceae	*Rosenbergiella*	*Rosenbergiella nectarea*
Pseudomonadota	Acetobacteraceae	*Roseomonas*	*Roseomonas aeriglobus*
Pseudomonadota	Acetobacteraceae	*Roseomonas*	*Roseomonas aerofrigidensis*
Pseudomonadota	Acetobacteraceae	*Roseomonas*	*Roseomonas gilardii*
Pseudomonadota	Acetobacteraceae	*Roseomonas*	*Roseomonas sediminicola*
Pseudomonadota	Acetobacteraceae	*Roseomonas*	*Roseomonas terrae*
Pseudomonadota	Acetobacteraceae	*Roseomonas*	*Roseomonas terricola*
Pseudomonadota	Acetobacteraceae	*Roseomonas*	*Roseomonas wooponensis*
Pseudomonadota	Enterobacteriaceae	*Rouxiella*	*Rouxiella chamberiensis*
Pseudomonadota	Enterobacteriaceae	*Rouxiella*	*Rouxiella silvae*
Pseudomonadota	Rhodobacteraceae	*Rubellimicrobium*	*Rubellimicrobium mesophilum*
Pseudomonadota	Rhodobacteraceae	*Rubellimicrobium*	*Rubellimicrobium roseum*
Pseudomonadota	Burkholderiaceae	*Rugamonas*	*Rugamonas rubra*
Pseudomonadota	Succinivibrionaceae	*Ruminobacter*	*Ruminobacter amylophilus*
Pseudomonadota	Acetobacteraceae	*Saccharibacter*	*Saccharibacter floricola*
Pseudomonadota	Halomonadaceae	*Salicola*	*Salicola marasensis*
Pseudomonadota	Halomonadaceae	*Salinicola*	*Salinicola acroporae*
Pseudomonadota	Halomonadaceae	*Salinicola*	*Salinicola halophilus*
Pseudomonadota	Vibrionaceae	*Salinivibrio*	*Salinivibrio proteolyticus*
Pseudomonadota	Vibrionaceae	*Salinivibrio*	*Salinivibrio siamensis*
Pseudomonadota	Enterobacteriaceae	*Salmonella*	*Salmonella bongori*
Pseudomonadota	Enterobacteriaceae	*Salmonella*	*Salmonella enterica*

Pseudomonadota	Pseudoalteromonadaceae	*Salsuginimonas*	*Salsuginimonas clara*
Pseudomonadota	Enterobacteriaceae	*Samsonia*	*Samsonia erythrinae*
Pseudomonadota	Sedimenticolaceae	*Sedimenticola*	*Sedimenticola selenatireducens*
Pseudomonadota	Enterobacteriaceae	*Serratia*	*Serratia aquatilis*
Pseudomonadota	Enterobacteriaceae	*Serratia*	*Serratia bozhouensis*
Pseudomonadota	Enterobacteriaceae	*Serratia*	*Serratia entomophila*
Pseudomonadota	Enterobacteriaceae	*Serratia*	*Serratia ficaria*
Pseudomonadota	Enterobacteriaceae	*Serratia*	*Serratia fonticola*
Pseudomonadota	Enterobacteriaceae	*Serratia*	*Serratia grimesii*
Pseudomonadota	Enterobacteriaceae	*Serratia*	*Serratia liquefaciens*
Pseudomonadota	Enterobacteriaceae	*Serratia*	*Serratia marcescens*
Pseudomonadota	Enterobacteriaceae	*Serratia*	*Serratia microhaemolytica*
Pseudomonadota	Enterobacteriaceae	*Serratia*	*Serratia nematodiphila*
Pseudomonadota	Enterobacteriaceae	*Serratia*	*Serratia odorifera*
Pseudomonadota	Enterobacteriaceae	*Serratia*	*Serratia oryzae*
Pseudomonadota	Enterobacteriaceae	*Serratia*	*Serratia plymuthica*
Pseudomonadota	Enterobacteriaceae	*Serratia*	*Serratia proteamaculans*
Pseudomonadota	Enterobacteriaceae	*Serratia*	*Serratia quinivorans*
Pseudomonadota	Enterobacteriaceae	*Serratia*	*Serratia rubidaea*
Pseudomonadota	Enterobacteriaceae	*Serratia*	*Serratia surfactantfaciens*
Pseudomonadota	Enterobacteriaceae	*Serratia*	*Serratia symbiotica*
Pseudomonadota	Enterobacteriaceae	*Serratia*	*Serratia ureilytica*

Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella algae*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella algidipiscicola*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella amazonensis*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella carassii*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella decolorationis*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella dokdonensis*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella donghaensis*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella fodinae*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella gelidii*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella indica*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella intestini*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella irciniae*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella japonica*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella khirikhana*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella litorisediminis*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella livingstonensis*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella loihica*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella mangrovi*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella marina*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella marisflavi*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella oneidensis*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella seohaensis*

Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella surugensis*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella violacea*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella waksmanii*
Pseudomonadota	Shewanellaceae	*Shewanella*	*Shewanella woodyi*
Pseudomonadota	Enterobacteriaceae	*Shigella*	*Shigella boydii*
Pseudomonadota	Enterobacteriaceae	*Shigella*	*Shigella dysenteriae*
Pseudomonadota	Enterobacteriaceae	*Shigella*	*Shigella flexneri*
Pseudomonadota	Enterobacteriaceae	*Shigella*	*Shigella sonnei*
Pseudomonadota	Enterobacteriaceae	*Shimwellia*	*Shimwellia blattae*
Pseudomonadota	Enterobacteriaceae	*Shimwellia*	*Shimwellia pseudoproteus*
Pseudomonadota	Rhizobiaceae	*Shinella*	*Shinella curvata*
Pseudomonadota	Rhizobiaceae	*Shinella*	*Shinella granuli*
Pseudomonadota	Rhizobiaceae	*Shinella*	*Shinella kummerowiae*
Pseudomonadota	Rhizobiaceae	*Shinella*	*Shinella yambaruensis*
Pseudomonadota	Rhizobiaceae	*Shinella*	*Shinella zoogloeoides*
Pseudomonadota	Enterobacteriaceae	*Siccibacter*	*Siccibacter colletis*
Pseudomonadota	Enterobacteriaceae	*Siccibacter*	*Siccibacter turicensis*
Pseudomonadota	Cellvibrionaceae	*Simiduia*	*Simiduia agarivorans*
Pseudomonadota	Rhizobiaceae	*Sinorhizobium*	*Sinorhizobium kostiense*
Pseudomonadota	Rhizobiaceae	*Sinorhizobium*	*Sinorhizobium saheli*
Pseudomonadota	Azospirillaceae	*Skermanella*	*Skermanella rosea*
Pseudomonadota	Sneathiellaceae	*Sneathiella*	*Sneathiella chinensis*

Pseudomonadota	Neisseriaceae	*Snodgrassella*	*Snodgrassella alvi*
Pseudomonadota	Sphingomonadaceae	*Sphingobium*	*Sphingobium aromaticiconvertens*
Pseudomonadota	Sphingomonadaceae	*Sphingobium*	*Sphingobium chinhatense*
Pseudomonadota	Sphingomonadaceae	*Sphingobium*	*Sphingobium fluviale*
Pseudomonadota	Sphingomonadaceae	*Sphingobium*	*Sphingobium fontiphilum*
Pseudomonadota	Sphingomonadaceae	*Sphingobium*	*Sphingobium phenoxybenzoativorans*
Pseudomonadota	Sphingomonadaceae	*Sphingomonas*	*Sphingomonas changbaiensis*
Pseudomonadota	Sphingomonadaceae	*Sphingomonas*	*Sphingomonas colocasiae*
Pseudomonadota	Sphingomonadaceae	*Sphingomonas*	*Sphingomonas crusticola*
Pseudomonadota	Sphingomonadaceae	*Sphingomonas*	*Sphingomonas haloaromaticamans*
Pseudomonadota	Sphingomonadaceae	*Sphingomonas*	*Sphingomonas japonica*
Pseudomonadota	Sphingomonadaceae	*Sphingomonas*	*Sphingomonas jatrophae*
Pseudomonadota	Sphingomonadaceae	*Sphingomonas*	*Sphingomonas kyeonggiensis*
Pseudomonadota	Sphingomonadaceae	*Sphingomonas*	*Sphingomonas laterariae*
Pseudomonadota	Sphingomonadaceae	*Sphingomonas*	*Sphingomonas lutea*
Pseudomonadota	Sphingomonadaceae	*Sphingomonas*	*Sphingomonas mali*
Pseudomonadota	Sphingomonadaceae	*Sphingomonas*	*Sphingomonas metalli*
Pseudomonadota	Sphingomonadaceae	*Sphingomonas*	*Sphingomonas mucosissima*
Pseudomonadota	Sphingomonadaceae	*Sphingomonas*	*Sphingomonas naasensis*
Pseudomonadota	Sphingomonadaceae	*Sphingomonas*	*Sphingomonas panacis*
Pseudomonadota	Sphingomonadaceae	*Sphingomonas*	*Sphingomonas parapaucimobilis*
Pseudomonadota	Sphingomonadaceae	*Sphingomonas*	*Sphingomonas roseiflava*

Pseudomonadota	Sphingomonadaceae	*Sphingomonas*	*Sphingomonas rubra*
Pseudomonadota	Sphingomonadaceae	*Sphingomonas*	*Sphingomonas yabuuchiae*
Pseudomonadota	Sphingomonadaceae	*Sphingomonas*	*Sphingomonas zeicaulis*
Pseudomonadota	Sphingomonadaceae	*Sphingopyxis*	*Sphingopyxis solisilvae*
Pseudomonadota	Sphingomonadaceae	*Sphingorhabdus*	*Sphingorhabdus buctiana*
Pseudomonadota	Sphingomonadaceae	*Sphingorhabdus*	*Sphingorhabdus contaminans*
Pseudomonadota	Sphingomonadaceae	*Sphingosinicella*	*Sphingosinicella soli*
Pseudomonadota	Nitrococcaceae	*Spiribacter*	*Spiribacter salinus*
Pseudomonadota	Stellaceae	*Stella*	*Stella humosa*
Pseudomonadota	Stellaceae	*Stella*	*Stella vacuolata*
Pseudomonadota	Xanthomonadaceae	*Stenotrophomonas*	*Stenotrophomonas maltophilia*
Pseudomonadota	Xanthomonadaceae	*Stenotrophomonas*	*Stenotrophomonas pavanii*
Pseudomonadota	Xanthomonadaceae	*Stenotrophomonas*	*Stenotrophomonas rhizophila*
Pseudomonadota	Steroidobacteraceae	*Steroidobacter*	*Steroidobacter denitrificans*
Pseudomonadota	Sulfuricellaceae	*Sulfuricella*	*Sulfuricella denitrificans*
Pseudomonadota	Sulfuriferulaceae	*Sulfuriferula*	*Sulfuriferula thiophila*
Pseudomonadota	Granulosicoccaceae	*Sulfuriflexus*	*Sulfuriflexus mobilis*
Pseudomonadota	Burkholderiaceae	*Sutterella*	*Sutterella massiliensis*
Pseudomonadota	Burkholderiaceae	*Sutterella*	*Sutterella stercoricanis*
Pseudomonadota	Rhodanobacteraceae	*Tahibacter*	*Tahibacter aquaticus*
Pseudomonadota	Enterobacteriaceae	*Tatumella*	*Tatumella citrea*
Pseudomonadota	Enterobacteriaceae	*Tatumella*	*Tatumella morbirosei*

Pseudomonadota	Enterobacteriaceae	*Tatumella*	*Tatumella ptyseos*
Pseudomonadota	Enterobacteriaceae	*Tatumella*	*Tatumella punctata*
Pseudomonadota	Enterobacteriaceae	*Tatumella*	*Tatumella saanichensis*
Pseudomonadota	Enterobacteriaceae	*Tatumella*	*Tatumella terrea*
Pseudomonadota	Burkholderiaceae	*Taylorella*	*Taylorella asinigenitalis*
Pseudomonadota	Burkholderiaceae	*Taylorella*	*Taylorella equigenitalis*
Pseudomonadota	Temperatibacteraceae	*Temperatibacter*	*Temperatibacter marinus*
Pseudomonadota	Tepidamorphaceae	*Tepidamorphus*	*Tepidamorphus gemmatus*
Pseudomonadota	Alteromonadaceae	*Thalassomonas*	*Thalassomonas actiniarum*
Pseudomonadota	Alteromonadaceae	*Thalassomonas*	*Thalassomonas haliotis*
Pseudomonadota	Alteromonadaceae	*Thalassomonas*	*Thalassomonas viridans*
Pseudomonadota	Thalassospiraceae	*Thalassospira*	*Thalassospira profundimaris*
Pseudomonadota	Alteromonadaceae	*Thalassotalea*	*Thalassotalea agariperforans*
Pseudomonadota	Alteromonadaceae	*Thalassotalea*	*Thalassotalea atypica*
Pseudomonadota	Alteromonadaceae	*Thalassotalea*	*Thalassotalea fusca*
Pseudomonadota	Alteromonadaceae	*Thalassotalea*	*Thalassotalea ganghwensis*
Pseudomonadota	Alteromonadaceae	*Thalassotalea*	*Thalassotalea litorea*
Pseudomonadota	Alteromonadaceae	*Thalassotalea*	*Thalassotalea piscium*
Pseudomonadota	Alteromonadaceae	*Thalassotalea*	*Thalassotalea ponticola*
Pseudomonadota	Alteromonadaceae	*Thalassotalea*	*Thalassotalea profundi*
Pseudomonadota	Rhodocyclaceae	*Thauera*	*Thauera linaloolentis*
Pseudomonadota	Rhodocyclaceae	*Thauera*	*Thauera phenylacetica*

Pseudomonadota	Rhodocyclaceae	*Thauera*	*Thauera sinica*
Pseudomonadota	Vibrionaceae	*Thaumasiovibrio*	*Thaumasiovibrio occultus*
Pseudomonadota	Vibrionaceae	*Thaumasiovibrio*	*Thaumasiovibrio subtropicus*
Pseudomonadota	Xanthomonadaceae	*Thermomonas*	*Thermomonas carbonis*
Pseudomonadota	Thioalkalivibrionaceae	*Thioalkalivibrio*	*Thioalkalivibrio nitratireducens*
Pseudomonadota	Thioalkalivibrionaceae	*Thioalkalivibrio*	*Thioalkalivibrio sulfidiphilus*
Pseudomonadota	Thiobacillaceae	*Thiobacillus*	*Thiobacillus thiophilus*
Pseudomonadota	Chromatiaceae	*Thiocapsa*	*Thiocapsa imhoffii*
Pseudomonadota	Thiohalomonadaceae	*Thiohalomonas*	*Thiohalomonas nitratireducens*
Pseudomonadota	Sedimenticolaceae	*Thiolapillus*	*Thiolapillus brandeum*
Pseudomonadota	Thiomicrospiraceae	*Thiomicrorhabdus*	*Thiomicrorhabdus psychrophila*
Pseudomonadota	Thiomicrospiraceae	*Thiomicrospira*	*Thiomicrospira sibirica*
Pseudomonadota	Chromatiaceae	*Thiorhodococcus*	*Thiorhodococcus mannitoliphagus*
Pseudomonadota	Ectothiorhodospiraceae	*Thiorhodospira*	*Thiorhodospira sibirica*
Pseudomonadota	Thiotrichaceae	*Thiothrix*	*Thiothrix defluvii*
Pseudomonadota	Enterobacteriaceae	*Thorsellia*	*Thorsellia anophelis*
Pseudomonadota	Phyllobacteriaceae	*Tianweitania*	*Tianweitania sediminis*
Pseudomonadota	Aeromonadaceae	*Tolumonas*	*Tolumonas auensis*
Pseudomonadota	Aeromonadaceae	*Tolumonas*	*Tolumonas osonensis*
Pseudomonadota	Enterobacteriaceae	*Trabulsiella*	*Trabulsiella guamensis*
Pseudomonadota	Enterobacteriaceae	*Trabulsiella*	*Trabulsiella odontotermitis*
Pseudomonadota	Rhodocyclaceae	*Uliginosibacterium*	*Uliginosibacterium sediminicola*

Pseudomonadota	Burkholderiaceae	*Undibacterium*	*Undibacterium terreum*
Pseudomonadota	Pasteurellaceae	*Ursidibacter*	*Ursidibacter maritimus*
Pseudomonadota	Burkholderiaceae	*Variovorax*	*Variovorax boronicumulans*
Pseudomonadota	Burkholderiaceae	*Variovorax*	*Variovorax defluvii*
Pseudomonadota	Burkholderiaceae	*Variovorax*	*Variovorax ginsengisoli*
Pseudomonadota	Burkholderiaceae	*Variovorax*	*Variovorax humicola*
Pseudomonadota	Burkholderiaceae	*Variovorax*	*Variovorax soli*
Pseudomonadota	Pasteurellaceae	*Vespertiliibacter*	*Vespertiliibacter pulmonis*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio aerogenes*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio aestuarianus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio agarivorans*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio alfacsensis*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio alginolyticus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio algivorus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio anguillarum*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio aphrogenes*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio astriarenae*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio atlanticus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio atypicus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio azureus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio bivalvicida*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio brasiliensis*

Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio breoganii*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio campbellii*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio caribbeanicus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio celticus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio cholerae*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio cincinnatiensis*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio comitans*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio coralliilyticus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio crassostreae*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio crosai*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio diazotrophicus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio europaeus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio ezurae*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio fluvialis*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio fortis*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio furnissii*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio gallaecicus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio gallicus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio gazogenes*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio gigantis*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio halioticoli*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio hangzhouensis*

Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio harveyi*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio hepatarius*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio hippocampi*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio hispanicus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio injenensis*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio inusitatus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio ishigakensis*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio japonicus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio jasicida*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio kanaloae*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio lentus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio litoralis*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio mangrovi*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio maritimus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio mediterranei*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio metoecus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio metschnikovii*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio mimicus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio mytili*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio natriegens*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio neocaledonicus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio neonatus*

Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio nereis*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio nigripulchritudo*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio olivae*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio orientalis*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio ostreicida*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio panuliri*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio parahaemolyticus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio pelagius*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio penaeicida*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio ponticus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio porteresiae*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio proteolyticus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio quintilis*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio rarus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio rotiferianus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio ruber*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio rumoiensis*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio salilacus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio scophthalmi*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio spartinae*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio splendidus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio stylophorae*

Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio superstes*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio tapetis*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio thalassae*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio toranzoniae*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio tritonius*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio tubiashii*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio vulnificus*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio xiamenensis*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio xuii*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio zhugei*
Pseudomonadota	Vibrionaceae	*Vibrio*	*Vibrio zhuhaiensis*
Pseudomonadota	Chromobacteriaceae	*Vogesella*	*Vogesella amnigena*
Pseudomonadota	Wenzhouxiangellaceae	*Wenzhouxiangella*	*Wenzhouxiangella salilacus*
Pseudomonadota	Wohlfahrtiimonadaceae	*Wohlfahrtiimonas*	*Wohlfahrtiimonas larvae*
Pseudomonadota	Xanthobacteraceae	*Xanthobacter*	*Xanthobacter agilis*
Pseudomonadota	Xanthomonadaceae	*Xanthomonas*	*Xanthomonas alfalfae*
Pseudomonadota	Xanthomonadaceae	*Xanthomonas*	*Xanthomonas campestris*
Pseudomonadota	Xanthomonadaceae	*Xanthomonas*	*Xanthomonas citri*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus beddingii*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus bovienii*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus cabanillasii*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus doucetiae*

Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus eapokensis*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus ehlersii*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus griffiniae*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus hominickii*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus indica*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus innexi*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus ishibashii*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus japonica*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus khoisanae*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus koppenhoeferi*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus kozodoii*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus magdalenensis*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus mauleonii*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus miraniensis*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus nematophila*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus poinarii*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus romanii*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus stockiae*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus szentirmaii*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus thuongxuanensis*
Pseudomonadota	Enterobacteriaceae	*Xenorhabdus*	*Xenorhabdus vietnamensis*
Pseudomonadota	Rhodobacteraceae	*Xinfangfangia*	*Xinfangfangia humi*

Pseudomonadota	Enterobacteriaceae	*Yersinia*	*Yersinia aldovae*
Pseudomonadota	Enterobacteriaceae	*Yersinia*	*Yersinia aleksiciae*
Pseudomonadota	Enterobacteriaceae	*Yersinia*	*Yersinia bercovieri*
Pseudomonadota	Enterobacteriaceae	*Yersinia*	*Yersinia enterocolitica*
Pseudomonadota	Enterobacteriaceae	*Yersinia*	*Yersinia entomophaga*
Pseudomonadota	Enterobacteriaceae	*Yersinia*	*Yersinia frederiksenii*
Pseudomonadota	Enterobacteriaceae	*Yersinia*	*Yersinia intermedia*
Pseudomonadota	Enterobacteriaceae	*Yersinia*	*Yersinia kristensenii*
Pseudomonadota	Enterobacteriaceae	*Yersinia*	*Yersinia massiliensis*
Pseudomonadota	Enterobacteriaceae	*Yersinia*	*Yersinia mollaretii*
Pseudomonadota	Enterobacteriaceae	*Yersinia*	*Yersinia nurmii*
Pseudomonadota	Enterobacteriaceae	*Yersinia*	*Yersinia pestis*
Pseudomonadota	Enterobacteriaceae	*Yersinia*	*Yersinia pseudotuberculosis*
Pseudomonadota	Enterobacteriaceae	*Yersinia*	*Yersinia rohdei*
Pseudomonadota	Enterobacteriaceae	*Yersinia*	*Yersinia ruckeri*
Pseudomonadota	Enterobacteriaceae	*Yersinia*	*Yersinia similis*
Pseudomonadota	Enterobacteriaceae	*Yersinia*	*Yersinia wautersii*
Pseudomonadota	Enterobacteriaceae	*Yokenella*	*Yokenella regensburgei*
Pseudomonadota	Burkholderiaceae	*Zhizhongheella*	*Zhizhongheella caldifontis*
Pseudomonadota	Aeromonadaceae	*Zobellella*	*Zobellella aerophila*
Pseudomonadota	Aeromonadaceae	*Zobellella*	*Zobellella denitrificans*
Pseudomonadota	Aeromonadaceae	*Zobellella*	*Zobellella taiwanensis*

Pseudomonadota	Rhodocyclaceae	*Zoogloea*	*Zoogloea oryzae*
Pseudomonadota	Zooshikellaceae	*Zooshikella*	*Zooshikella ganghwensis*
Spirochaetota	Alkalispirochaetaceae	*Alkalispirochaeta*	*Alkalispirochaeta alkalica*
Spirochaetota	Alkalispirochaetaceae	*Alkalispirochaeta*	*Alkalispirochaeta sphaeroplastigenens*
Spirochaetota	Breznakiellaceae	*Breznakiella*	*Breznakiella homolactica*
Spirochaetota	Spirochaetaceae	*Spirochaeta*	*Spirochaeta halophila*
Spirochaetota	Spirochaetaceae	*Spirochaeta*	*Spirochaeta isovalerica*
Spirochaetota	Treponemataceae	*Treponema*	*Treponema denticola*
Spirochaetota	Treponemataceae	*Treponema*	*Treponema putidum*
Synergistota	Acetomicrobiaceae	*Acetomicrobium*	*Acetomicrobium mobile*
Synergistota	Aminobacteriaceae	*Aminobacterium*	*Aminobacterium mobile*
Synergistota	Synergistaceae	*Cloacibacillus*	*Cloacibacillus porcorum*
Synergistota	Aminobacteriaceae	*Fretibacterium*	*Fretibacterium fastidiosum*
Synergistota	Synergistaceae	*Thermanaerovibrio*	*Thermanaerovibrio acidaminovorans*
Synergistota	Synergistaceae	*Thermanaerovibrio*	*Thermanaerovibrio velox*
Terrabacteria	Synechococcales	*Cymatolege*	*Cymatolege isodiametrica*
Terrabacteria	Entomoplasmataceae	*Mesoplasma*	*Mesoplasma syrphidae*
Terrabacteria	Synechococcales	*Metis*	*Metis fasciculata*
Terrabacteria	Oculatellaceae	*Oculatella*	*Oculatella cataractarum*
Terrabacteria	Oculatellaceae	*Timaviella*	*Timaviella obliquedivisa*
Terrabacteria	Trichocoleusaceae	*Trichocoleus*	*Trichocoleus caatingensis*
Terrabacteria	Trichocoleusaceae	*Trichocoleus*	*Trichocoleus desertorum*

Thermodesulfobiota	Thermodesulfobiaceae	*Geothermobacterium*	*Geothermobacterium ferrireducens*
Thermotogota	Fervidobacteriaceae	*Thermosipho*	*Thermosipho melanesiensis*
Verrucomicrobiota	Akkermansiaceae	*Akkermansia*	*Akkermansia glycaniphila*
Verrucomicrobiota	Akkermansiaceae	*Akkermansia*	*Akkermansia muciniphila*
Verrucomicrobiota	Victivallaceae	*Victivallis*	*Victivallis vadensis*

Appendix 2:

The correlation network between all studied bacterial genus.

This table showed the positive and negative correlation networks between each bacterial genus, together with its P-value.

Taxon1	Taxon2	Correlation	P-value
Acinetobacter	*Bacillus*	0.3842	0.0198
Acinetobacter	*Citrobacter*	-0.3164	0.0396
Acinetobacter	*Erwinia*	-0.364	0.0297
Acinetobacter	*Escherichia*	-0.3858	0.0198
Acinetobacter	*Franconibacter*	-0.3573	0.0396
Acinetobacter	*Gemella*	0.434	0.0099
Acinetobacter	*Granulicatella*	0.509	0.0099
Acinetobacter	*Kurthia*	0.479	0.0099
Acinetobacter	*Leuconostoc*	0.3239	0.0198
Acinetobacter	*Paraclostridium*	0.3369	0.0297
Acinetobacter	*Pasteurella*	0.3037	0.0297
Acinetobacter	*Providencia*	-0.3425	0.0495
Acinetobacter	*Salmonella*	-0.4629	0.0297
Acinetobacter	*Serratia*	-0.4625	0.0099
Acinetobacter	*Shigella*	-0.3197	0.0297
Acinetobacter	*Streptococcus*	0.5407	0.0099
Acinetobacter	*Trichococcus*	0.3749	0.0198
Actinobacillus	*Bavariicoccus*	0.5328	0.0099
Actinobacillus	*Citrobacter*	-0.4215	0.0099
Actinobacillus	*Clostridium*	-0.3908	0.0198

Actinobacillus	*Enterobacter*	-0.3114	0.0297
Actinobacillus	*Granulicatella*	0.3462	0.0396
Actinobacillus	*Haemophilus*	0.5853	0.0099
Actinobacillus	*Helicobacter*	0.5115	0.0099
Actinobacillus	*Klebsiella*	-0.3311	0.0495
Actinobacillus	*Kurthia*	0.3967	0.0198
Actinobacillus	*Lactococcus*	-0.3535	0.0198
Actinobacillus	*Mannheimia*	0.669	0.0099
Actinobacillus	*Mixta*	-0.3471	0.0099
Actinobacillus	*Mycoplasma*	0.5849	0.0099
Actinobacillus	*Paenibacillus*	0.4342	0.0099
Actinobacillus	*Pasteurella*	0.4786	0.0099
Actinobacillus	*Shigella*	-0.3606	0.0396
Actinobacillus	*Streptococcus*	0.4182	0.0297
Actinobacillus	*Trichococcus*	0.469	0.0099
Actinobacillus	*Ureaplasma*	0.4727	0.0099
Atlantibacter	*Cronobacter*	0.3334	0.0495
Atlantibacter	*Franconibacter*	0.3631	0.0495
Atlantibacter	*Haemophilus*	-0.3576	0.0198
Atlantibacter	*Izhakiella*	0.4682	0.0099
Atlantibacter	*Pseudescherichia*	0.493	0.0099
Atlantibacter	*Siccibacter*	0.4172	0.0297
Bacillus	*Acinetobacter*	0.3842	0.0198
Bacillus	*Cedecea*	-0.4438	0.0099
Bacillus	*Christensenella*	-0.3824	0.0297
Bacillus	*Citrobacter*	-0.4	0.0396
Bacillus	*Enterobacter*	-0.4726	0.0099
Bacillus	*Escherichia*	-0.5801	0.0099
Bacillus	*Granulicatella*	0.3959	0.0198
Bacillus	*Kosakonia*	-0.3351	0.0396

Bacillus	*Kurthia*	0.3566	0.0198
Bacillus	*Macrococcus*	0.3296	0.0495
Bacillus	*Pseudocitrobacter*	-0.397	0.0495
Bacillus	*Salmonella*	-0.3804	0.0495
Bacillus	*Shimwellia*	0.335	0.0297
Bacillus	*Staphylococcus*	0.5592	0.0099
Bacillus	*Streptococcus*	0.4191	0.0198
Bacillus	*Trichococcus*	0.3344	0.0396
Bacillus	*Weissella*	0.4446	0.0099
Bacillus	*Yokenella*	-0.4931	0.0099
Bavariicoccus	*Actinobacillus*	0.5328	0.0099
Bavariicoccus	*Clostridium*	-0.4016	0.0297
Bavariicoccus	*Cronobacter*	-0.3919	0.0198
Bavariicoccus	*Dickeya*	-0.3574	0.0099
Bavariicoccus	*Haemophilus*	0.5733	0.0099
Bavariicoccus	*Ligilactobacillus*	0.4203	0.0099
Bavariicoccus	*Mannheimia*	0.4553	0.0099
Bavariicoccus	*Mycoplasma*	0.3801	0.0198
Bavariicoccus	*Paenibacillus*	0.4385	0.0198
Bavariicoccus	*Pasteurella*	0.5518	0.0099
Bavariicoccus	*Providencia*	-0.3582	0.0297
Bavariicoccus	*Pseudescherichia*	-0.347	0.0297
Bavariicoccus	*Raoultella*	-0.4196	0.0198
Bavariicoccus	*Serratia*	-0.3736	0.0396
Bavariicoccus	*Shigella*	-0.3707	0.0297
Bavariicoccus	*Shimwellia*	-0.3483	0.0396
Bavariicoccus	*Streptococcus*	0.3608	0.0198
Bavariicoccus	*Tatumella*	-0.4053	0.0198
Bavariicoccus	*Ureaplasma*	0.5308	0.0198
Biostraticola	*Franconibacter*	0.3466	0.0495

Biostraticola	*Gibbsiella*	0.507	0.0099
Biostraticola	*Photobacterium*	0.3853	0.0198
Biostraticola	*Proteus*	0.3399	0.0099
Biostraticola	*Pseudescherichia*	0.3338	0.0297
Blautia	*Christensenella*	0.5776	0.0099
Blautia	*Enterococcus*	0.3819	0.0297
Blautia	*Fournierella*	0.6397	0.0099
Blautia	*Metakosakonia*	-0.3645	0.0198
Blautia	*Ruminococcus*	0.7408	0.0099
Blautia	*Serratia*	-0.3613	0.0297
Blautia	*Shigella*	-0.4126	0.0297
Blautia	*Vibrio*	-0.3768	0.0297
Budvicia	*Hafnia*	0.5166	0.0099
Budvicia	*Listeria*	-0.3745	0.0198
Budvicia	*Pluralibacter*	0.4375	0.0297
Budvicia	*Vagococcus*	-0.3248	0.0396
Budvicia	*Yersinia*	0.3834	0.0396
Buttiauxella	*Franconibacter*	-0.3205	0.0495
Buttiauxella	*Klebsiella*	0.3821	0.0099
Buttiauxella	*Metakosakonia*	-0.3676	0.0198
Buttiauxella	*Pectobacterium*	0.4766	0.0099
Carnobacterium	*Cedecea*	0.3084	0.0495
Carnobacterium	*Eubacterium*	-0.3595	0.0198
Carnobacterium	*Isobaculum*	0.3129	0.0297
Carnobacterium	*Lactobacillus*	0.3806	0.0297
Carnobacterium	*Ligilactobacillus*	0.3648	0.0297
Carnobacterium	*Paenibacillus*	0.3511	0.0396
Carnobacterium	*Pluralibacter*	-0.3568	0.0396
Carnobacterium	*Siccibacter*	-0.3527	0.0396
Carnobacterium	*Vagococcus*	0.5132	0.0099

Carnobacterium	*Yersinia*	-0.3969	0.0099
Cedecea	*Bacillus*	-0.4438	0.0099
Cedecea	*Carnobacterium*	0.3084	0.0495
Cedecea	*Clostridium*	-0.3432	0.0396
Cedecea	*Enterobacter*	0.3631	0.0396
Cedecea	*Granulicatella*	-0.3918	0.0099
Cedecea	*Klebsiella*	0.4756	0.0099
Cedecea	*Leclercia*	0.4063	0.0099
Cedecea	*Salmonella*	0.4032	0.0198
Cedecea	*Yokenella*	0.6762	0.0099
Chania	*Edwardsiella*	0.3566	0.0396
Chania	*Escherichia*	0.4078	0.0198
Chania	*Pluralibacter*	0.5963	0.0099
Chania	*Proteus*	0.347	0.0198
Chania	*Pseudomonas*	-0.3227	0.0495
Chania	*Shigella*	0.3818	0.0297
Chania	*Streptococcus*	-0.3947	0.0198
Christensenella	*Bacillus*	-0.3824	0.0297
Christensenella	*Blautia*	0.5776	0.0099
Christensenella	*Enterococcus*	0.3349	0.0396
Christensenella	*Eubacterium*	0.3672	0.0297
Christensenella	*Fournierella*	0.525	0.0099
Christensenella	*Helicobacter*	-0.3081	0.0396
Christensenella	*Pectobacterium*	0.3249	0.0396
Christensenella	*Proteus*	-0.3087	0.0297
Christensenella	*Pseudocitrobacter*	0.4891	0.0099
Christensenella	*Raoultella*	0.3583	0.0297
Christensenella	*Rosenbergiella*	-0.452	0.0099
Christensenella	*Ruminococcus*	0.6056	0.0099
Christensenella	*Staphylococcus*	-0.3469	0.0297

Citrobacter	*Acinetobacter*	-0.3164	0.0396
Citrobacter	*Actinobacillus*	-0.4215	0.0099
Citrobacter	*Bacillus*	-0.4	0.0396
Citrobacter	*Enterobacter*	0.5026	0.0099
Citrobacter	*Escherichia*	0.4639	0.0198
Citrobacter	*Granulicatella*	-0.4637	0.0099
Citrobacter	*Helicobacter*	-0.3729	0.0396
Citrobacter	*Kurthia*	-0.4204	0.0099
Citrobacter	*Leclercia*	0.3693	0.0297
Citrobacter	*Marinilactibacillus*	-0.3332	0.0495
Citrobacter	*Pectobacterium*	0.4695	0.0099
Citrobacter	*Pseudocitrobacter*	0.3168	0.0495
Citrobacter	*Raoultella*	0.4536	0.0198
Citrobacter	*Salmonella*	0.3954	0.0099
Citrobacter	*Serratia*	0.4353	0.0198
Citrobacter	*Shigella*	0.3888	0.0297
Citrobacter	*Streptococcus*	-0.412	0.0198
Citrobacter	*Tatumella*	0.3978	0.0099
Citrobacter	*Ureaplasma*	-0.3508	0.0297
Citrobacter	*Yokenella*	0.3335	0.0495
Clostridium	*Actinobacillus*	-0.3908	0.0198
Clostridium	*Bavariicoccus*	-0.4016	0.0297
Clostridium	*Cedecea*	-0.3432	0.0396
Clostridium	*Haemophilus*	-0.3511	0.0198
Clostridium	*Lactococcus*	0.4624	0.0099
Clostridium	*Mannheimia*	-0.3495	0.0495
Clostridium	*Paeniclostridium*	0.4639	0.0198
Clostridium	*Paraclostridium*	0.3745	0.0198
Clostridium	*Romboutsia*	0.5493	0.0099
Cronobacter	*Atlantibacter*	0.3334	0.0495

Cronobacter	*Bavariicoccus*	-0.3919	0.0198
Cronobacter	*Dickeya*	0.3321	0.0198
Cronobacter	*Enterobacter*	0.3379	0.0198
Cronobacter	*Escherichia*	0.4095	0.0198
Cronobacter	*Franconibacter*	0.4267	0.0198
Cronobacter	*Granulicatella*	-0.3617	0.0099
Cronobacter	*Haemophilus*	-0.3605	0.0297
Cronobacter	*Kosakonia*	0.5063	0.0099
Cronobacter	*Metakosakonia*	0.3907	0.0099
Cronobacter	*Mixta*	0.4012	0.0099
Cronobacter	*Mycoplasma*	-0.3953	0.0297
Cronobacter	*Pasteurella*	-0.315	0.0396
Cronobacter	*Ruminococcus*	-0.3173	0.0396
Cronobacter	*Salmonella*	0.618	0.0099
Cronobacter	*Serratia*	0.3406	0.0198
Cronobacter	*Shigella*	0.6403	0.0099
Cronobacter	*Streptococcus*	-0.3182	0.0396
Cronobacter	*Vibrio*	0.4224	0.0099
Cronobacter	*Xenorhabdus*	0.4922	0.0198
Dickeya	*Bavariicoccus*	-0.3574	0.0099
Dickeya	*Cronobacter*	0.3321	0.0198
Dickeya	*Izhakiella*	0.4064	0.0297
Dickeya	*Kluyvera*	0.4305	0.0198
Dickeya	*Morganella*	0.3963	0.0099
Dickeya	*Mycoplasma*	-0.3846	0.0198
Dickeya	*Paraclostridium*	-0.3942	0.0297
Dickeya	*Photobacterium*	-0.3548	0.0198
Dickeya	*Providencia*	0.5505	0.0099
Dickeya	*Pseudomonas*	0.3816	0.0396
Dickeya	*Raoultella*	0.3699	0.0198

Dickeya	*Romboutsia*	-0.3419	0.0297
Dickeya	*Tatumella*	0.4993	0.0198
Dickeya	*Vibrio*	0.3813	0.0297
Dickeya	*Xenorhabdus*	0.3542	0.0297
Edwardsiella	*Chania*	0.3566	0.0396
Edwardsiella	*Erwinia*	0.377	0.0297
Edwardsiella	*Kluyvera*	0.4033	0.0099
Edwardsiella	*Lactococcus*	-0.4313	0.0099
Edwardsiella	*Pectobacterium*	0.3396	0.0099
Edwardsiella	*Raoultella*	0.3045	0.0396
Enterobacter	*Actinobacillus*	-0.3114	0.0297
Enterobacter	*Bacillus*	-0.4726	0.0099
Enterobacter	*Cedecea*	0.3631	0.0396
Enterobacter	*Citrobacter*	0.5026	0.0099
Enterobacter	*Cronobacter*	0.3379	0.0198
Enterobacter	*Erwinia*	0.3618	0.0297
Enterobacter	*Escherichia*	0.3999	0.0297
Enterobacter	*Klebsiella*	0.5679	0.0099
Enterobacter	*Kosakonia*	0.4822	0.0099
Enterobacter	*Kurthia*	-0.4709	0.0099
Enterobacter	*Leclercia*	0.3925	0.0099
Enterobacter	*Leuconostoc*	-0.3497	0.0198
Enterobacter	*Mycoplasma*	-0.3497	0.0297
Enterobacter	*Pasteurella*	-0.4231	0.0198
Enterobacter	*Pectobacterium*	0.459	0.0198
Enterobacter	*Salmonella*	0.538	0.0099
Enterobacter	*Serratia*	0.5062	0.0099
Enterobacter	*Shigella*	0.3925	0.0396
Enterobacter	*Staphylococcus*	-0.4373	0.0198
Enterobacter	*Trichococcus*	-0.4412	0.0099

Enterobacter	*Weissella*	-0.3407	0.0297
Enterobacter	*Yokenella*	0.5015	0.0099
Enterococcus	*Blautia*	0.3819	0.0297
Enterococcus	*Christensenella*	0.3349	0.0396
Enterococcus	*Erwinia*	-0.5718	0.0198
Enterococcus	*Fournierella*	0.3284	0.0396
Enterococcus	*Helicobacter*	-0.3331	0.0495
Enterococcus	*Lactococcus*	0.4315	0.0297
Enterococcus	*Serratia*	-0.3241	0.0297
Enterococcus	*Vibrio*	-0.4023	0.0297
Enterococcus	*Xenorhabdus*	-0.5466	0.0099
Erwinia	*Acinetobacter*	-0.364	0.0297
Erwinia	*Edwardsiella*	0.377	0.0297
Erwinia	*Enterobacter*	0.3618	0.0297
Erwinia	*Enterococcus*	-0.5718	0.0198
Erwinia	*Granulicatella*	-0.3057	0.0396
Erwinia	*Kluyvera*	0.7023	0.0099
Erwinia	*Pasteurella*	-0.3845	0.0198
Erwinia	*Pectobacterium*	0.6341	0.0099
Erwinia	*Providencia*	0.4059	0.0198
Erwinia	*Raoultella*	0.4259	0.0099
Erwinia	*Salmonella*	0.5556	0.0099
Erwinia	*Serratia*	0.6181	0.0099
Erwinia	*Shimwellia*	0.4046	0.0198
Erwinia	*Tatumella*	0.5327	0.0099
Erwinia	*Ureaplasma*	-0.339	0.0099
Erwinia	*Vibrio*	0.5508	0.0099
Erwinia	*Xenorhabdus*	0.5617	0.0099
Escherichia	*Acinetobacter*	-0.3858	0.0198
Escherichia	*Bacillus*	-0.5801	0.0099

Escherichia	*Chania*	0.4078	0.0198
Escherichia	*Citrobacter*	0.4639	0.0198
Escherichia	*Cronobacter*	0.4095	0.0198
Escherichia	*Enterobacter*	0.3999	0.0297
Escherichia	*Franconibacter*	0.5597	0.0099
Escherichia	*Kosakonia*	0.4767	0.0099
Escherichia	*Kurthia*	-0.3559	0.0198
Escherichia	*Marinilactibacillus*	-0.4071	0.0198
Escherichia	*Metakosakonia*	0.4047	0.0099
Escherichia	*Mixta*	0.4378	0.0099
Escherichia	*Pluralibacter*	0.3897	0.0099
Escherichia	*Pseudocitrobacter*	0.3549	0.0297
Escherichia	*Salmonella*	0.4244	0.0099
Escherichia	*Shigella*	0.73	0.0099
Escherichia	*Siccibacter*	0.3027	0.0396
Escherichia	*Streptococcus*	-0.4507	0.0198
Escherichia	*Trichococcus*	-0.332	0.0396
Escherichia	*Weissella*	-0.3619	0.0099
Escherichia	*Yokenella*	0.3462	0.0396
Eubacterium	*Carnobacterium*	-0.3595	0.0198
Eubacterium	*Christensenella*	0.3672	0.0297
Eubacterium	*Melissococcus*	-0.3057	0.0495
Eubacterium	*Yersinia*	0.419	0.0099
Fournierella	*Blautia*	0.6397	0.0099
Fournierella	*Christensenella*	0.525	0.0099
Fournierella	*Enterococcus*	0.3284	0.0396
Fournierella	*Ligilactobacillus*	0.3729	0.0198
Fournierella	*Pseudocitrobacter*	0.423	0.0099
Fournierella	*Ruminococcus*	0.4433	0.0099
Fournierella	*Vibrio*	-0.3089	0.0396

Franconibacter	*Acinetobacter*	-0.3573	0.0396
Franconibacter	*Atlantibacter*	0.3631	0.0495
Franconibacter	*Biostraticola*	0.3466	0.0495
Franconibacter	*Buttiauxella*	-0.3205	0.0495
Franconibacter	*Cronobacter*	0.4267	0.0198
Franconibacter	*Escherichia*	0.5597	0.0099
Franconibacter	*Kosakonia*	0.5417	0.0099
Franconibacter	*Metakosakonia*	0.4274	0.0198
Franconibacter	*Pantoea*	0.3392	0.0297
Franconibacter	*Proteus*	0.3235	0.0495
Franconibacter	*Shigella*	0.6309	0.0099
Franconibacter	*Yokenella*	0.327	0.0198
Gemella	*Acinetobacter*	0.434	0.0099
Gemella	*Kurthia*	0.5025	0.0099
Gemella	*Marinilactibacillus*	0.448	0.0099
Gemella	*Streptococcus*	0.3431	0.0495
Gemella	*Trichococcus*	0.3153	0.0297
Gibbsiella	*Biostraticola*	0.507	0.0099
Gibbsiella	*Ligilactobacillus*	-0.4298	0.0099
Gibbsiella	*Macrococcus*	-0.3564	0.0297
Gibbsiella	*Photobacterium*	0.3761	0.0396
Gibbsiella	*Proteus*	0.5386	0.0099
Granulicatella	*Acinetobacter*	0.509	0.0099
Granulicatella	*Actinobacillus*	0.3462	0.0396
Granulicatella	*Bacillus*	0.3959	0.0198
Granulicatella	*Cedecea*	-0.3918	0.0099
Granulicatella	*Citrobacter*	-0.4637	0.0099
Granulicatella	*Cronobacter*	-0.3617	0.0099
Granulicatella	*Erwinia*	-0.3057	0.0396
Granulicatella	*Isobaculum*	0.4071	0.0198

Granulicatella	*Kurthia*	0.3282	0.0297
Granulicatella	*Macrococcus*	0.3354	0.0297
Granulicatella	*Salmonella*	-0.386	0.0297
Granulicatella	*Shimwellia*	-0.3206	0.0396
Granulicatella	*Tatumella*	-0.3672	0.0396
Granulicatella	*Trichococcus*	0.3423	0.0396
Granulicatella	*Ureaplasma*	0.3226	0.0297
Granulicatella	*Yokenella*	-0.3469	0.0198
Haemophilus	*Actinobacillus*	0.5853	0.0099
Haemophilus	*Atlantibacter*	-0.3576	0.0198
Haemophilus	*Bavariicoccus*	0.5733	0.0099
Haemophilus	*Clostridium*	-0.3511	0.0198
Haemophilus	*Cronobacter*	-0.3605	0.0297
Haemophilus	*Helicobacter*	0.3988	0.0099
Haemophilus	*Klebsiella*	-0.4184	0.0198
Haemophilus	*Kurthia*	0.4754	0.0099
Haemophilus	*Mannheimia*	0.6277	0.0099
Haemophilus	*Mycoplasma*	0.5735	0.0099
Haemophilus	*Paenibacillus*	0.4343	0.0198
Haemophilus	*Pasteurella*	0.655	0.0099
Haemophilus	*Raoultella*	-0.3884	0.0198
Haemophilus	*Shimwellia*	-0.4644	0.0198
Haemophilus	*Streptococcus*	0.5493	0.0099
Haemophilus	*Trichococcus*	0.553	0.0099
Haemophilus	*Ureaplasma*	0.5417	0.0099
Hafnia	*Budvicia*	0.5166	0.0099
Hafnia	*Ligilactobacillus*	-0.3019	0.0495
Hafnia	*Photobacterium*	0.4773	0.0099
Hafnia	*Pluralibacter*	0.3037	0.0198
Hafnia	*Ruminococcus*	-0.3083	0.0495

Hafnia	*Vagococcus*	-0.3519	0.0099
Hafnia	*Yersinia*	0.5751	0.0099
Helicobacter	*Actinobacillus*	0.5115	0.0099
Helicobacter	*Christensenella*	-0.3081	0.0396
Helicobacter	*Citrobacter*	-0.3729	0.0396
Helicobacter	*Enterococcus*	-0.3331	0.0495
Helicobacter	*Haemophilus*	0.3988	0.0099
Helicobacter	*Mycoplasma*	0.5608	0.0099
Helicobacter	*Pasteurella*	0.377	0.0297
Helicobacter	*Raoultella*	-0.4213	0.0099
Helicobacter	*Siccibacter*	0.3731	0.0297
Helicobacter	*Staphylococcus*	0.3803	0.0099
Helicobacter	*Streptococcus*	0.3966	0.0198
Helicobacter	*Trichococcus*	0.318	0.0297
Helicobacter	*Ureaplasma*	0.539	0.0099
Isobaculum	*Carnobacterium*	0.3129	0.0297
Isobaculum	*Granulicatella*	0.4071	0.0198
Isobaculum	*Klebsiella*	-0.367	0.0099
Isobaculum	*Ligilactobacillus*	0.5186	0.0099
Isobaculum	*Listeria*	0.3871	0.0099
Isobaculum	*Phytobacter*	0.3137	0.0297
Isobaculum	*Pseudescherichia*	0.3677	0.0198
Izhakiella	*Atlantibacter*	0.4682	0.0099
Izhakiella	*Dickeya*	0.4064	0.0297
Izhakiella	*Metakosakonia*	0.3624	0.0495
Izhakiella	*Mixta*	0.4453	0.0099
Izhakiella	*Pseudescherichia*	0.5416	0.0099
Izhakiella	*Siccibacter*	0.3745	0.0099
Izhakiella	*Staphylococcus*	-0.3478	0.0495
Klebsiella	*Actinobacillus*	-0.3311	0.0495

Klebsiella	*Buttiauxella*	0.3821	0.0099
Klebsiella	*Cedecea*	0.4756	0.0099
Klebsiella	*Enterobacter*	0.5679	0.0099
Klebsiella	*Haemophilus*	-0.4184	0.0198
Klebsiella	*Isobaculum*	-0.367	0.0099
Klebsiella	*Kluyvera*	0.3384	0.0495
Klebsiella	*Kurthia*	-0.4172	0.0099
Klebsiella	*Leclercia*	0.4041	0.0198
Klebsiella	*Mannheimia*	-0.3949	0.0099
Klebsiella	*Pectobacterium*	0.4446	0.0099
Klebsiella	*Raoultella*	0.3959	0.0198
Klebsiella	*Salmonella*	0.408	0.0297
Klebsiella	*Tatumella*	0.3057	0.0297
Klebsiella	*Trichococcus*	-0.5835	0.0099
Klebsiella	*Yokenella*	0.3911	0.0198
Kluyvera	*Dickeya*	0.4305	0.0198
Kluyvera	*Edwardsiella*	0.4033	0.0099
Kluyvera	*Erwinia*	0.7023	0.0099
Kluyvera	*Klebsiella*	0.3384	0.0495
Kluyvera	*Ligilactobacillus*	-0.4051	0.0297
Kluyvera	*Moellerella*	-0.3681	0.0396
Kluyvera	*Paeniclostridium*	-0.3265	0.0297
Kluyvera	*Pantoea*	0.3544	0.0396
Kluyvera	*Pectobacterium*	0.5224	0.0099
Kluyvera	*Providencia*	0.4508	0.0198
Kluyvera	*Raoultella*	0.6313	0.0099
Kluyvera	*Salmonella*	0.4193	0.0099
Kluyvera	*Serratia*	0.4746	0.0198
Kluyvera	*Shimwellia*	0.3899	0.0099
Kluyvera	*Tatumella*	0.6855	0.0099

Kluyvera	*Vibrio*	0.3782	0.0099
Kluyvera	*Xenorhabdus*	0.4662	0.0099
Kosakonia	*Bacillus*	-0.3351	0.0396
Kosakonia	*Cronobacter*	0.5063	0.0099
Kosakonia	*Enterobacter*	0.4822	0.0099
Kosakonia	*Escherichia*	0.4767	0.0099
Kosakonia	*Franconibacter*	0.5417	0.0099
Kosakonia	*Lactobacillus*	-0.4506	0.0396
Kosakonia	*Leuconostoc*	-0.3615	0.0297
Kosakonia	*Mannheimia*	-0.4052	0.0396
Kosakonia	*Paenibacillus*	-0.4608	0.0198
Kosakonia	*Pasteurella*	-0.4061	0.0297
Kosakonia	*Pectobacterium*	0.322	0.0495
Kosakonia	*Salmonella*	0.4303	0.0297
Kosakonia	*Serratia*	0.503	0.0099
Kosakonia	*Shigella*	0.6063	0.0099
Kosakonia	*Vibrio*	0.4423	0.0198
Kosakonia	*Xenorhabdus*	0.3264	0.0396
Kosakonia	*Yokenella*	0.3191	0.0495
Kurthia	*Acinetobacter*	0.479	0.0099
Kurthia	*Actinobacillus*	0.3967	0.0198
Kurthia	*Bacillus*	0.3566	0.0198
Kurthia	*Citrobacter*	-0.4204	0.0099
Kurthia	*Enterobacter*	-0.4709	0.0099
Kurthia	*Escherichia*	-0.3559	0.0198
Kurthia	*Gemella*	0.5025	0.0099
Kurthia	*Granulicatella*	0.3282	0.0297
Kurthia	*Haemophilus*	0.4754	0.0099
Kurthia	*Klebsiella*	-0.4172	0.0099
Kurthia	*Mannheimia*	0.4371	0.0099

Kurthia	*Marinilactibacillus*	0.3841	0.0099
Kurthia	*Pasteurella*	0.4108	0.0099
Kurthia	*Pectobacterium*	-0.3939	0.0297
Kurthia	*Salmonella*	-0.3653	0.0495
Kurthia	*Serratia*	-0.3429	0.0297
Kurthia	*Staphylococcus*	0.3493	0.0198
Kurthia	*Streptococcus*	0.5494	0.0099
Kurthia	*Trichococcus*	0.6954	0.0099
Kurthia	*Ureaplasma*	0.3235	0.0495
Kurthia	*Yokenella*	-0.3475	0.0198
Lactobacillus	*Carnobacterium*	0.3806	0.0297
Lactobacillus	*Kosakonia*	-0.4506	0.0396
Lactobacillus	*Leuconostoc*	0.3972	0.0297
Lactobacillus	*Macrococcus*	0.348	0.0396
Lactobacillus	*Salmonella*	-0.344	0.0099
Lactobacillus	*Serratia*	-0.3241	0.0396
Lactobacillus	*Shigella*	-0.4345	0.0099
Lactobacillus	*Yersinia*	-0.3317	0.0495
Lactococcus	*Actinobacillus*	-0.3535	0.0198
Lactococcus	*Clostridium*	0.4624	0.0099
Lactococcus	*Edwardsiella*	-0.4313	0.0099
Lactococcus	*Enterococcus*	0.4315	0.0297
Lactococcus	*Paeniclostridium*	0.4284	0.0099
Leclercia	*Cedecea*	0.4063	0.0099
Leclercia	*Citrobacter*	0.3693	0.0297
Leclercia	*Enterobacter*	0.3925	0.0099
Leclercia	*Klebsiella*	0.4041	0.0198
Leclercia	*Pantoea*	0.3673	0.0396
Leclercia	*Serratia*	0.3868	0.0198
Leclercia	*Yokenella*	0.3624	0.0396

Leuconostoc	*Acinetobacter*	0.3239	0.0198
Leuconostoc	*Enterobacter*	-0.3497	0.0198
Leuconostoc	*Kosakonia*	-0.3615	0.0297
Leuconostoc	*Lactobacillus*	0.3972	0.0297
Leuconostoc	*Macrococcus*	0.3851	0.0099
Leuconostoc	*Providencia*	-0.3312	0.0396
Leuconostoc	*Streptococcus*	0.3526	0.0198
Leuconostoc	*Trichococcus*	0.3384	0.0396
Leuconostoc	*Weissella*	0.5311	0.0099
Ligilactobacillus	*Bavariicoccus*	0.4203	0.0099
Ligilactobacillus	*Carnobacterium*	0.3648	0.0297
Ligilactobacillus	*Fournierella*	0.3729	0.0198
Ligilactobacillus	*Gibbsiella*	-0.4298	0.0099
Ligilactobacillus	*Hafnia*	-0.3019	0.0495
Ligilactobacillus	*Isobaculum*	0.5186	0.0099
Ligilactobacillus	*Kluyvera*	-0.4051	0.0297
Ligilactobacillus	*Paenibacillus*	0.3331	0.0297
Ligilactobacillus	*Photobacterium*	-0.3354	0.0495
Ligilactobacillus	*Shigella*	-0.3149	0.0396
Ligilactobacillus	*Tatumella*	-0.3643	0.0297
Ligilactobacillus	*Xenorhabdus*	-0.3133	0.0495
Listeria	*Budvicia*	-0.3745	0.0198
Listeria	*Isobaculum*	0.3871	0.0099
Listeria	*Macrococcus*	0.4791	0.0099
Listeria	*Marinilactibacillus*	0.5106	0.0099
Listeria	*Providencia*	0.3041	0.0396
Listeria	*Vagococcus*	0.3114	0.0396
Macrococcus	*Bacillus*	0.3296	0.0495
Macrococcus	*Gibbsiella*	-0.3564	0.0297
Macrococcus	*Granulicatella*	0.3354	0.0297

Macrococcus	*Lactobacillus*	0.348	0.0396
Macrococcus	*Leuconostoc*	0.3851	0.0099
Macrococcus	*Listeria*	0.4791	0.0099
Macrococcus	*Melissococcus*	0.4999	0.0198
Macrococcus	*Pseudocitrobacter*	-0.3604	0.0495
Macrococcus	*Staphylococcus*	0.4111	0.0198
Macrococcus	*Weissella*	0.4192	0.0198
Mannheimia	*Actinobacillus*	0.669	0.0099
Mannheimia	*Bavariicoccus*	0.4553	0.0099
Mannheimia	*Clostridium*	-0.3495	0.0495
Mannheimia	*Haemophilus*	0.6277	0.0099
Mannheimia	*Klebsiella*	-0.3949	0.0099
Mannheimia	*Kosakonia*	-0.4052	0.0396
Mannheimia	*Kurthia*	0.4371	0.0099
Mannheimia	*Mycoplasma*	0.4437	0.0099
Mannheimia	*Paenibacillus*	0.3936	0.0198
Mannheimia	*Pasteurella*	0.4241	0.0099
Mannheimia	*Raoultella*	-0.3714	0.0396
Mannheimia	*Serratia*	-0.4255	0.0099
Mannheimia	*Tatumella*	-0.3074	0.0495
Mannheimia	*Ureaplasma*	0.3493	0.0099
Marinilactibacillus	*Citrobacter*	-0.3332	0.0495
Marinilactibacillus	*Escherichia*	-0.4071	0.0198
Marinilactibacillus	*Gemella*	0.448	0.0099
Marinilactibacillus	*Kurthia*	0.3841	0.0099
Marinilactibacillus	*Listeria*	0.5106	0.0099
Marinilactibacillus	*Pluralibacter*	-0.3475	0.0198
Marinilactibacillus	*Shigella*	-0.3829	0.0198
Marinilactibacillus	*Streptococcus*	0.3223	0.0297
Marinilactibacillus	*Trichococcus*	0.4474	0.0099

Marinilactibacillus	*Vagococcus*	0.3304	0.0297
Melissococcus	*Eubacterium*	-0.3057	0.0495
Melissococcus	*Macrococcus*	0.4999	0.0198
Metakosakonia	*Blautia*	-0.3645	0.0198
Metakosakonia	*Buttiauxella*	-0.3676	0.0198
Metakosakonia	*Cronobacter*	0.3907	0.0099
Metakosakonia	*Escherichia*	0.4047	0.0099
Metakosakonia	*Franconibacter*	0.4274	0.0198
Metakosakonia	*Izhakiella*	0.3624	0.0495
Metakosakonia	*Mixta*	0.5871	0.0099
Metakosakonia	*Paenibacillus*	-0.3167	0.0495
Metakosakonia	*Ruminococcus*	-0.3828	0.0198
Metakosakonia	*Salmonella*	0.3717	0.0099
Metakosakonia	*Shigella*	0.4389	0.0198
Metakosakonia	*Siccibacter*	0.4481	0.0099
Mixta	*Actinobacillus*	-0.3471	0.0099
Mixta	*Cronobacter*	0.4012	0.0099
Mixta	*Escherichia*	0.4378	0.0099
Mixta	*Izhakiella*	0.4453	0.0099
Mixta	*Metakosakonia*	0.5871	0.0099
Mixta	*Pluralibacter*	0.3627	0.0297
Mixta	*Pseudescherichia*	0.4189	0.0198
Mixta	*Salmonella*	0.4866	0.0198
Mixta	*Shigella*	0.5015	0.0099
Moellerella	*Kluyvera*	-0.3681	0.0396
Moellerella	*Paeniclostridium*	0.3546	0.0198
Moellerella	*Paraclostridium*	0.3262	0.0099
Moellerella	*Romboutsia*	0.3687	0.0396
Moellerella	*Shimwellia*	-0.3746	0.0297
Moellerella	*Tatumella*	-0.4287	0.0099

Morganella	*Dickeya*	0.3963	0.0099
Morganella	*Proteus*	0.3168	0.0495
Morganella	*Providencia*	0.7478	0.0099
Morganella	*Rosenbergiella*	0.3979	0.0099
Morganella	*Serratia*	0.3889	0.0495
Morganella	*Vibrio*	0.4214	0.0099
Mycoplasma	*Actinobacillus*	0.5849	0.0099
Mycoplasma	*Bavariicoccus*	0.3801	0.0198
Mycoplasma	*Cronobacter*	-0.3953	0.0297
Mycoplasma	*Dickeya*	-0.3846	0.0198
Mycoplasma	*Enterobacter*	-0.3497	0.0297
Mycoplasma	*Haemophilus*	0.5735	0.0099
Mycoplasma	*Helicobacter*	0.5608	0.0099
Mycoplasma	*Mannheimia*	0.4437	0.0099
Mycoplasma	*Pasteurella*	0.6328	0.0099
Mycoplasma	*Photobacterium*	0.311	0.0495
Mycoplasma	*Providencia*	-0.3199	0.0495
Mycoplasma	*Salmonella*	-0.4857	0.0099
Mycoplasma	*Serratia*	-0.4153	0.0396
Mycoplasma	*Shimwellia*	-0.3647	0.0198
Mycoplasma	*Staphylococcus*	0.3469	0.0198
Mycoplasma	*Streptococcus*	0.4261	0.0099
Mycoplasma	*Ureaplasma*	0.6229	0.0099
Mycoplasma	*Vagococcus*	-0.4097	0.0297
Mycoplasma	*Vibrio*	-0.3932	0.0198
Paenibacillus	*Actinobacillus*	0.4342	0.0099
Paenibacillus	*Bavariicoccus*	0.4385	0.0198
Paenibacillus	*Carnobacterium*	0.3511	0.0396
Paenibacillus	*Haemophilus*	0.4343	0.0198
Paenibacillus	*Kosakonia*	-0.4608	0.0198

Paenibacillus	*Ligilactobacillus*	0.3331	0.0297
Paenibacillus	*Mannheimia*	0.3936	0.0198
Paenibacillus	*Metakosakonia*	-0.3167	0.0495
Paenibacillus	*Pasteurella*	0.4318	0.0099
Paenibacillus	*Shigella*	-0.3484	0.0297
Paenibacillus	*Vibrio*	-0.337	0.0495
Paeniclostridium	*Clostridium*	0.4639	0.0198
Paeniclostridium	*Kluyvera*	-0.3265	0.0297
Paeniclostridium	*Lactococcus*	0.4284	0.0099
Paeniclostridium	*Moellerella*	0.3546	0.0198
Paeniclostridium	*Paraclostridium*	0.4382	0.0198
Paeniclostridium	*Romboutsia*	0.5205	0.0099
Paeniclostridium	*Rosenbergiella*	0.3739	0.0099
Pantoea	*Franconibacter*	0.3392	0.0297
Pantoea	*Kluyvera*	0.3544	0.0396
Pantoea	*Leclercia*	0.3673	0.0396
Pantoea	*Shimwellia*	0.3379	0.0198
Paraclostridium	*Acinetobacter*	0.3369	0.0297
Paraclostridium	*Clostridium*	0.3745	0.0198
Paraclostridium	*Dickeya*	-0.3942	0.0297
Paraclostridium	*Moellerella*	0.3262	0.0099
Paraclostridium	*Paeniclostridium*	0.4382	0.0198
Paraclostridium	*Romboutsia*	0.6427	0.0099
Paraclostridium	*Xenorhabdus*	-0.4331	0.0198
Pasteurella	*Acinetobacter*	0.3037	0.0297
Pasteurella	*Actinobacillus*	0.4786	0.0099
Pasteurella	*Bavariicoccus*	0.5518	0.0099
Pasteurella	*Cronobacter*	-0.315	0.0396
Pasteurella	*Enterobacter*	-0.4231	0.0198
Pasteurella	*Erwinia*	-0.3845	0.0198

Pasteurella	*Haemophilus*	0.655	0.0099
Pasteurella	*Helicobacter*	0.377	0.0297
Pasteurella	*Kosakonia*	-0.4061	0.0297
Pasteurella	*Kurthia*	0.4108	0.0099
Pasteurella	*Mannheimia*	0.4241	0.0099
Pasteurella	*Mycoplasma*	0.6328	0.0099
Pasteurella	*Paenibacillus*	0.4318	0.0099
Pasteurella	*Pectobacterium*	-0.4388	0.0198
Pasteurella	*Providencia*	-0.3939	0.0495
Pasteurella	*Raoultella*	-0.3572	0.0297
Pasteurella	*Salmonella*	-0.419	0.0099
Pasteurella	*Serratia*	-0.5208	0.0099
Pasteurella	*Streptococcus*	0.5268	0.0099
Pasteurella	*Trichococcus*	0.4351	0.0099
Pasteurella	*Ureaplasma*	0.6275	0.0099
Pasteurella	*Vibrio*	-0.3526	0.0396
Pasteurella	*Yokenella*	-0.373	0.0396
Pectobacterium	*Buttiauxella*	0.4766	0.0099
Pectobacterium	*Christensenella*	0.3249	0.0396
Pectobacterium	*Citrobacter*	0.4695	0.0099
Pectobacterium	*Edwardsiella*	0.3396	0.0099
Pectobacterium	*Enterobacter*	0.459	0.0198
Pectobacterium	*Erwinia*	0.6341	0.0099
Pectobacterium	*Klebsiella*	0.4446	0.0099
Pectobacterium	*Kluyvera*	0.5224	0.0099
Pectobacterium	*Kosakonia*	0.322	0.0495
Pectobacterium	*Kurthia*	-0.3939	0.0297
Pectobacterium	*Pasteurella*	-0.4388	0.0198
Pectobacterium	*Providencia*	0.4203	0.0198
Pectobacterium	*Pseudocitrobacter*	0.4279	0.0198

Pectobacterium	*Raoultella*	0.65	0.0099
Pectobacterium	*Salmonella*	0.5301	0.0099
Pectobacterium	*Serratia*	0.414	0.0198
Pectobacterium	*Streptococcus*	-0.4921	0.0099
Pectobacterium	*Tatumella*	0.394	0.0198
Pectobacterium	*Trichococcus*	-0.4712	0.0099
Pectobacterium	*Ureaplasma*	-0.4338	0.0099
Pectobacterium	*Vibrio*	0.4001	0.0099
Pectobacterium	*Xenorhabdus*	0.5049	0.0099
Pectobacterium	*Yokenella*	0.4971	0.0099
Photobacterium	*Biostraticola*	0.3853	0.0198
Photobacterium	*Dickeya*	-0.3548	0.0198
Photobacterium	*Gibbsiella*	0.3761	0.0396
Photobacterium	*Hafnia*	0.4773	0.0099
Photobacterium	*Ligilactobacillus*	-0.3354	0.0495
Photobacterium	*Mycoplasma*	0.311	0.0495
Photobacterium	*Phytobacter*	0.5858	0.0099
Photobacterium	*Pluralibacter*	0.3706	0.0099
Photobacterium	*Vagococcus*	-0.4566	0.0099
Phytobacter	*Isobaculum*	0.3137	0.0297
Phytobacter	*Photobacterium*	0.5858	0.0099
Phytobacter	*Pseudescherichia*	0.5157	0.0099
Phytobacter	*Pseudomonas*	-0.3742	0.0198
Pluralibacter	*Budvicia*	0.4375	0.0297
Pluralibacter	*Carnobacterium*	-0.3568	0.0396
Pluralibacter	*Chania*	0.5963	0.0099
Pluralibacter	*Escherichia*	0.3897	0.0099
Pluralibacter	*Hafnia*	0.3037	0.0198
Pluralibacter	*Marinilactibacillus*	-0.3475	0.0198
Pluralibacter	*Mixta*	0.3627	0.0297

Pluralibacter	*Photobacterium*	0.3706	0.0099
Pluralibacter	*Pseudescherichia*	0.3341	0.0099
Pluralibacter	*Pseudocitrobacter*	0.5008	0.0099
Pluralibacter	*Shimwellia*	0.439	0.0099
Pluralibacter	*Streptococcus*	-0.3956	0.0198
Pluralibacter	*Vagococcus*	-0.386	0.0198
Pluralibacter	*Yokenella*	0.3162	0.0495
Proteus	*Biostraticola*	0.3399	0.0099
Proteus	*Chania*	0.347	0.0198
Proteus	*Christensenella*	-0.3087	0.0297
Proteus	*Franconibacter*	0.3235	0.0495
Proteus	*Gibbsiella*	0.5386	0.0099
Proteus	*Morganella*	0.3168	0.0495
Proteus	*Providencia*	0.4384	0.0099
Proteus	*Rosenbergiella*	0.4688	0.0099
Proteus	*Ruminococcus*	-0.3348	0.0495
Proteus	*Vibrio*	0.3142	0.0495
Providencia	*Acinetobacter*	-0.3425	0.0495
Providencia	*Bavariicoccus*	-0.3582	0.0297
Providencia	*Dickeya*	0.5505	0.0099
Providencia	*Erwinia*	0.4059	0.0198
Providencia	*Kluyvera*	0.4508	0.0198
Providencia	*Leuconostoc*	-0.3312	0.0396
Providencia	*Listeria*	0.3041	0.0396
Providencia	*Morganella*	0.7478	0.0099
Providencia	*Mycoplasma*	-0.3199	0.0495
Providencia	*Pasteurella*	-0.3939	0.0495
Providencia	*Pectobacterium*	0.4203	0.0198
Providencia	*Proteus*	0.4384	0.0099
Providencia	*Raoultella*	0.5158	0.0198

Providencia	*Serratia*	0.4387	0.0099
Providencia	*Tatumella*	0.4987	0.0099
Providencia	*Ureaplasma*	-0.3793	0.0297
Providencia	*Vibrio*	0.5619	0.0099
Providencia	*Xenorhabdus*	0.5304	0.0099
Pseudescherichia	*Atlantibacter*	0.493	0.0099
Pseudescherichia	*Bavariicoccus*	-0.347	0.0297
Pseudescherichia	*Biostraticola*	0.3338	0.0297
Pseudescherichia	*Isobaculum*	0.3677	0.0198
Pseudescherichia	*Izhakiella*	0.5416	0.0099
Pseudescherichia	*Mixta*	0.4189	0.0198
Pseudescherichia	*Phytobacter*	0.5157	0.0099
Pseudescherichia	*Pluralibacter*	0.3341	0.0099
Pseudocitrobacter	*Bacillus*	-0.397	0.0495
Pseudocitrobacter	*Christensenella*	0.4891	0.0099
Pseudocitrobacter	*Citrobacter*	0.3168	0.0495
Pseudocitrobacter	*Escherichia*	0.3549	0.0297
Pseudocitrobacter	*Fournierella*	0.423	0.0099
Pseudocitrobacter	*Macrococcus*	-0.3604	0.0495
Pseudocitrobacter	*Pectobacterium*	0.4279	0.0198
Pseudocitrobacter	*Pluralibacter*	0.5008	0.0099
Pseudocitrobacter	*Raoultella*	0.3397	0.0396
Pseudocitrobacter	*Ruminococcus*	0.3277	0.0495
Pseudocitrobacter	*Yokenella*	0.372	0.0297
Pseudomonas	*Chania*	-0.3227	0.0495
Pseudomonas	*Dickeya*	0.3816	0.0396
Pseudomonas	*Phytobacter*	-0.3742	0.0198
Raoultella	*Bavariicoccus*	-0.4196	0.0198
Raoultella	*Christensenella*	0.3583	0.0297
Raoultella	*Citrobacter*	0.4536	0.0198

Raoultella	*Dickeya*	0.3699	0.0198
Raoultella	*Edwardsiella*	0.3045	0.0396
Raoultella	*Erwinia*	0.4259	0.0099
Raoultella	*Haemophilus*	-0.3884	0.0198
Raoultella	*Helicobacter*	-0.4213	0.0099
Raoultella	*Klebsiella*	0.3959	0.0198
Raoultella	*Kluyvera*	0.6313	0.0099
Raoultella	*Mannheimia*	-0.3714	0.0396
Raoultella	*Pasteurella*	-0.3572	0.0297
Raoultella	*Pectobacterium*	0.65	0.0099
Raoultella	*Providencia*	0.5158	0.0198
Raoultella	*Pseudocitrobacter*	0.3397	0.0396
Raoultella	*Serratia*	0.3548	0.0396
Raoultella	*Shimwellia*	0.3615	0.0297
Raoultella	*Streptococcus*	-0.3605	0.0495
Raoultella	*Tatumella*	0.6603	0.0099
Raoultella	*Trichococcus*	-0.3376	0.0396
Raoultella	*Ureaplasma*	-0.4147	0.0099
Raoultella	*Vibrio*	0.3166	0.0297
Raoultella	*Yersinia*	0.4311	0.0099
Raoultella	*Yokenella*	0.355	0.0396
Romboutsia	*Clostridium*	0.5493	0.0099
Romboutsia	*Dickeya*	-0.3419	0.0297
Romboutsia	*Moellerella*	0.3687	0.0396
Romboutsia	*Paeniclostridium*	0.5205	0.0099
Romboutsia	*Paraclostridium*	0.6427	0.0099
Rosenbergiella	*Christensenella*	-0.452	0.0099
Rosenbergiella	*Morganella*	0.3979	0.0099
Rosenbergiella	*Paeniclostridium*	0.3739	0.0099
Rosenbergiella	*Proteus*	0.4688	0.0099

Rosenbergiella	*Weissella*	0.3939	0.0099
Ruminococcus	*Blautia*	0.7408	0.0099
Ruminococcus	*Christensenella*	0.6056	0.0099
Ruminococcus	*Cronobacter*	-0.3173	0.0396
Ruminococcus	*Fournierella*	0.4433	0.0099
Ruminococcus	*Hafnia*	-0.3083	0.0495
Ruminococcus	*Metakosakonia*	-0.3828	0.0198
Ruminococcus	*Proteus*	-0.3348	0.0495
Ruminococcus	*Pseudocitrobacter*	0.3277	0.0495
Ruminococcus	*Vibrio*	-0.3984	0.0099
Salmonella	*Acinetobacter*	-0.4629	0.0297
Salmonella	*Bacillus*	-0.3804	0.0495
Salmonella	*Cedecea*	0.4032	0.0198
Salmonella	*Citrobacter*	0.3954	0.0099
Salmonella	*Cronobacter*	0.618	0.0099
Salmonella	*Enterobacter*	0.538	0.0099
Salmonella	*Erwinia*	0.5556	0.0099
Salmonella	*Escherichia*	0.4244	0.0099
Salmonella	*Granulicatella*	-0.386	0.0297
Salmonella	*Klebsiella*	0.408	0.0297
Salmonella	*Kluyvera*	0.4193	0.0099
Salmonella	*Kosakonia*	0.4303	0.0297
Salmonella	*Kurthia*	-0.3653	0.0495
Salmonella	*Lactobacillus*	-0.344	0.0099
Salmonella	*Metakosakonia*	0.3717	0.0099
Salmonella	*Mixta*	0.4866	0.0198
Salmonella	*Mycoplasma*	-0.4857	0.0099
Salmonella	*Pasteurella*	-0.419	0.0099
Salmonella	*Pectobacterium*	0.5301	0.0099
Salmonella	*Serratia*	0.451	0.0198

Salmonella	*Shigella*	0.5488	0.0099
Salmonella	*Siccibacter*	0.3291	0.0396
Salmonella	*Staphylococcus*	-0.3939	0.0396
Salmonella	*Streptococcus*	-0.5499	0.0099
Salmonella	*Tatumella*	0.3474	0.0297
Salmonella	*Trichococcus*	-0.4962	0.0198
Salmonella	*Vibrio*	0.3822	0.0297
Salmonella	*Yokenella*	0.6827	0.0099
Serratia	*Acinetobacter*	-0.4625	0.0099
Serratia	*Bavariicoccus*	-0.3736	0.0396
Serratia	*Blautia*	-0.3613	0.0297
Serratia	*Citrobacter*	0.4353	0.0198
Serratia	*Cronobacter*	0.3406	0.0198
Serratia	*Enterobacter*	0.5062	0.0099
Serratia	*Enterococcus*	-0.3241	0.0297
Serratia	*Erwinia*	0.6181	0.0099
Serratia	*Kluyvera*	0.4746	0.0198
Serratia	*Kosakonia*	0.503	0.0099
Serratia	*Kurthia*	-0.3429	0.0297
Serratia	*Lactobacillus*	-0.3241	0.0396
Serratia	*Leclercia*	0.3868	0.0198
Serratia	*Mannheimia*	-0.4255	0.0099
Serratia	*Morganella*	0.3889	0.0495
Serratia	*Mycoplasma*	-0.4153	0.0396
Serratia	*Pasteurella*	-0.5208	0.0099
Serratia	*Pectobacterium*	0.414	0.0198
Serratia	*Providencia*	0.4387	0.0099
Serratia	*Raoultella*	0.3548	0.0396
Serratia	*Salmonella*	0.451	0.0198
Serratia	*Shigella*	0.4591	0.0099

Serratia	*Streptococcus*	-0.378	0.0297
Serratia	*Tatumella*	0.344	0.0099
Serratia	*Ureaplasma*	-0.4753	0.0099
Serratia	*Vibrio*	0.4248	0.0099
Serratia	*Xenorhabdus*	0.4406	0.0198
Shigella	*Acinetobacter*	-0.3197	0.0297
Shigella	*Actinobacillus*	-0.3606	0.0396
Shigella	*Bavariicoccus*	-0.3707	0.0297
Shigella	*Blautia*	-0.4126	0.0297
Shigella	*Chania*	0.3818	0.0297
Shigella	*Citrobacter*	0.3888	0.0297
Shigella	*Cronobacter*	0.6403	0.0099
Shigella	*Enterobacter*	0.3925	0.0396
Shigella	*Escherichia*	0.73	0.0099
Shigella	*Franconibacter*	0.6309	0.0099
Shigella	*Kosakonia*	0.6063	0.0099
Shigella	*Lactobacillus*	-0.4345	0.0099
Shigella	*Ligilactobacillus*	-0.3149	0.0396
Shigella	*Marinilactibacillus*	-0.3829	0.0198
Shigella	*Metakosakonia*	0.4389	0.0198
Shigella	*Mixta*	0.5015	0.0099
Shigella	*Paenibacillus*	-0.3484	0.0297
Shigella	*Salmonella*	0.5488	0.0099
Shigella	*Serratia*	0.4591	0.0099
Shigella	*Siccibacter*	0.3395	0.0495
Shigella	*Streptococcus*	-0.345	0.0297
Shimwellia	*Bacillus*	0.335	0.0297
Shimwellia	*Bavariicoccus*	-0.3483	0.0396
Shimwellia	*Erwinia*	0.4046	0.0198
Shimwellia	*Granulicatella*	-0.3206	0.0396

Shimwellia	*Haemophilus*	-0.4644	0.0198
Shimwellia	*Kluyvera*	0.3899	0.0099
Shimwellia	*Moellerella*	-0.3746	0.0297
Shimwellia	*Mycoplasma*	-0.3647	0.0198
Shimwellia	*Pantoea*	0.3379	0.0198
Shimwellia	*Pluralibacter*	0.439	0.0099
Shimwellia	*Raoultella*	0.3615	0.0297
Shimwellia	*Tatumella*	0.4391	0.0198
Shimwellia	*Ureaplasma*	-0.3842	0.0297
Shimwellia	*Vibrio*	0.3415	0.0396
Siccibacter	*Atlantibacter*	0.4172	0.0297
Siccibacter	*Carnobacterium*	-0.3527	0.0396
Siccibacter	*Escherichia*	0.3027	0.0396
Siccibacter	*Helicobacter*	0.3731	0.0297
Siccibacter	*Izhakiella*	0.3745	0.0099
Siccibacter	*Metakosakonia*	0.4481	0.0099
Siccibacter	*Salmonella*	0.3291	0.0396
Siccibacter	*Shigella*	0.3395	0.0495
Siccibacter	*Vagococcus*	-0.4111	0.0198
Staphylococcus	*Bacillus*	0.5592	0.0099
Staphylococcus	*Christensenella*	-0.3469	0.0297
Staphylococcus	*Enterobacter*	-0.4373	0.0198
Staphylococcus	*Helicobacter*	0.3803	0.0099
Staphylococcus	*Izhakiella*	-0.3478	0.0495
Staphylococcus	*Kurthia*	0.3493	0.0198
Staphylococcus	*Macrococcus*	0.4111	0.0198
Staphylococcus	*Mycoplasma*	0.3469	0.0198
Staphylococcus	*Salmonella*	-0.3939	0.0396
Staphylococcus	*Streptococcus*	0.4265	0.0099
Staphylococcus	*Trichococcus*	0.4805	0.0099

Staphylococcus	*Weissella*	0.436	0.0099
Staphylococcus	*Yokenella*	-0.4568	0.0198
Streptococcus	*Acinetobacter*	0.5407	0.0099
Streptococcus	*Actinobacillus*	0.4182	0.0297
Streptococcus	*Bacillus*	0.4191	0.0198
Streptococcus	*Bavariicoccus*	0.3608	0.0198
Streptococcus	*Chania*	-0.3947	0.0198
Streptococcus	*Citrobacter*	-0.412	0.0198
Streptococcus	*Cronobacter*	-0.3182	0.0396
Streptococcus	*Escherichia*	-0.4507	0.0198
Streptococcus	*Gemella*	0.3431	0.0495
Streptococcus	*Haemophilus*	0.5493	0.0099
Streptococcus	*Helicobacter*	0.3966	0.0198
Streptococcus	*Kurthia*	0.5494	0.0099
Streptococcus	*Leuconostoc*	0.3526	0.0198
Streptococcus	*Marinilactibacillus*	0.3223	0.0297
Streptococcus	*Mycoplasma*	0.4261	0.0099
Streptococcus	*Pasteurella*	0.5268	0.0099
Streptococcus	*Pectobacterium*	-0.4921	0.0099
Streptococcus	*Pluralibacter*	-0.3956	0.0198
Streptococcus	*Raoultella*	-0.3605	0.0495
Streptococcus	*Salmonella*	-0.5499	0.0099
Streptococcus	*Serratia*	-0.378	0.0297
Streptococcus	*Shigella*	-0.345	0.0297
Streptococcus	*Staphylococcus*	0.4265	0.0099
Streptococcus	*Tatumella*	-0.3303	0.0297
Streptococcus	*Trichococcus*	0.555	0.0198
Streptococcus	*Ureaplasma*	0.5659	0.0099
Streptococcus	*Yokenella*	-0.5505	0.0099
Tatumella	*Bavariicoccus*	-0.4053	0.0198

Tatumella	*Citrobacter*	0.3978	0.0099
Tatumella	*Dickeya*	0.4993	0.0198
Tatumella	*Erwinia*	0.5327	0.0099
Tatumella	*Granulicatella*	-0.3672	0.0396
Tatumella	*Klebsiella*	0.3057	0.0297
Tatumella	*Kluyvera*	0.6855	0.0099
Tatumella	*Ligilactobacillus*	-0.3643	0.0297
Tatumella	*Mannheimia*	-0.3074	0.0495
Tatumella	*Moellerella*	-0.4287	0.0099
Tatumella	*Pectobacterium*	0.394	0.0198
Tatumella	*Providencia*	0.4987	0.0099
Tatumella	*Raoultella*	0.6603	0.0099
Tatumella	*Salmonella*	0.3474	0.0297
Tatumella	*Serratia*	0.344	0.0099
Tatumella	*Shimwellia*	0.4391	0.0198
Tatumella	*Streptococcus*	-0.3303	0.0297
Tatumella	*Ureaplasma*	-0.3913	0.0099
Tatumella	*Vibrio*	0.4467	0.0297
Trichococcus	*Acinetobacter*	0.3749	0.0198
Trichococcus	*Actinobacillus*	0.469	0.0099
Trichococcus	*Bacillus*	0.3344	0.0396
Trichococcus	*Enterobacter*	-0.4412	0.0099
Trichococcus	*Escherichia*	-0.332	0.0396
Trichococcus	*Gemella*	0.3153	0.0297
Trichococcus	*Granulicatella*	0.3423	0.0396
Trichococcus	*Haemophilus*	0.553	0.0099
Trichococcus	*Helicobacter*	0.318	0.0297
Trichococcus	*Klebsiella*	-0.5835	0.0099
Trichococcus	*Kurthia*	0.6954	0.0099
Trichococcus	*Leuconostoc*	0.3384	0.0396

Trichococcus	*Marinilactibacillus*	0.4474	0.0099
Trichococcus	*Pasteurella*	0.4351	0.0099
Trichococcus	*Pectobacterium*	-0.4712	0.0099
Trichococcus	*Raoultella*	-0.3376	0.0396
Trichococcus	*Salmonella*	-0.4962	0.0198
Trichococcus	*Staphylococcus*	0.4805	0.0099
Trichococcus	*Streptococcus*	0.555	0.0198
Trichococcus	*Weissella*	0.3955	0.0099
Trichococcus	*Yokenella*	-0.4188	0.0198
Ureaplasma	*Actinobacillus*	0.4727	0.0099
Ureaplasma	*Bavariicoccus*	0.5308	0.0198
Ureaplasma	*Citrobacter*	-0.3508	0.0297
Ureaplasma	*Erwinia*	-0.339	0.0099
Ureaplasma	*Granulicatella*	0.3226	0.0297
Ureaplasma	*Haemophilus*	0.5417	0.0099
Ureaplasma	*Helicobacter*	0.539	0.0099
Ureaplasma	*Kurthia*	0.3235	0.0495
Ureaplasma	*Mannheimia*	0.3493	0.0099
Ureaplasma	*Mycoplasma*	0.6229	0.0099
Ureaplasma	*Pasteurella*	0.6275	0.0099
Ureaplasma	*Pectobacterium*	-0.4338	0.0099
Ureaplasma	*Providencia*	-0.3793	0.0297
Ureaplasma	*Raoultella*	-0.4147	0.0099
Ureaplasma	*Serratia*	-0.4753	0.0099
Ureaplasma	*Shimwellia*	-0.3842	0.0297
Ureaplasma	*Streptococcus*	0.5659	0.0099
Ureaplasma	*Tatumella*	-0.3913	0.0099
Ureaplasma	*Vibrio*	-0.4072	0.0099
Vagococcus	*Budvicia*	-0.3248	0.0396
Vagococcus	*Carnobacterium*	0.5132	0.0099

Vagococcus	*Hafnia*	-0.3519	0.0099
Vagococcus	*Listeria*	0.3114	0.0396
Vagococcus	*Marinilactibacillus*	0.3304	0.0297
Vagococcus	*Mycoplasma*	-0.4097	0.0297
Vagococcus	*Photobacterium*	-0.4566	0.0099
Vagococcus	*Pluralibacter*	-0.386	0.0198
Vagococcus	*Siccibacter*	-0.4111	0.0198
Vagococcus	*Yersinia*	-0.349	0.0198
Vibrio	*Blautia*	-0.3768	0.0297
Vibrio	*Cronobacter*	0.4224	0.0099
Vibrio	*Dickeya*	0.3813	0.0297
Vibrio	*Enterococcus*	-0.4023	0.0297
Vibrio	*Erwinia*	0.5508	0.0099
Vibrio	*Fournierella*	-0.3089	0.0396
Vibrio	*Kluyvera*	0.3782	0.0099
Vibrio	*Kosakonia*	0.4423	0.0198
Vibrio	*Morganella*	0.4214	0.0099
Vibrio	*Mycoplasma*	-0.3932	0.0198
Vibrio	*Paenibacillus*	-0.337	0.0495
Vibrio	*Pasteurella*	-0.3526	0.0396
Vibrio	*Pectobacterium*	0.4001	0.0099
Vibrio	*Proteus*	0.3142	0.0495
Vibrio	*Providencia*	0.5619	0.0099
Vibrio	*Raoultella*	0.3166	0.0297
Vibrio	*Ruminococcus*	-0.3984	0.0099
Vibrio	*Salmonella*	0.3822	0.0297
Vibrio	*Serratia*	0.4248	0.0099
Vibrio	*Shimwellia*	0.3415	0.0396
Vibrio	*Tatumella*	0.4467	0.0297
Vibrio	*Ureaplasma*	-0.4072	0.0099

Vibrio	*Xenorhabdus*	0.4424	0.0099
Weissella	*Bacillus*	0.4446	0.0099
Weissella	*Enterobacter*	-0.3407	0.0297
Weissella	*Escherichia*	-0.3619	0.0099
Weissella	*Leuconostoc*	0.5311	0.0099
Weissella	*Macrococcus*	0.4192	0.0198
Weissella	*Rosenbergiella*	0.3939	0.0099
Weissella	*Staphylococcus*	0.436	0.0099
Weissella	*Trichococcus*	0.3955	0.0099
Weissella	*Yokenella*	-0.432	0.0297
Xenorhabdus	*Cronobacter*	0.4922	0.0198
Xenorhabdus	*Dickeya*	0.3542	0.0297
Xenorhabdus	*Enterococcus*	-0.5466	0.0099
Xenorhabdus	*Erwinia*	0.5617	0.0099
Xenorhabdus	*Kluyvera*	0.4662	0.0099
Xenorhabdus	*Kosakonia*	0.3264	0.0396
Xenorhabdus	*Ligilactobacillus*	-0.3133	0.0495
Xenorhabdus	*Paraclostridium*	-0.4331	0.0198
Xenorhabdus	*Pectobacterium*	0.5049	0.0099
Xenorhabdus	*Providencia*	0.5304	0.0099
Xenorhabdus	*Serratia*	0.4406	0.0198
Xenorhabdus	*Vibrio*	0.4424	0.0099
Yersinia	*Budvicia*	0.3834	0.0396
Yersinia	*Carnobacterium*	-0.3969	0.0099
Yersinia	*Eubacterium*	0.419	0.0099
Yersinia	*Hafnia*	0.5751	0.0099
Yersinia	*Lactobacillus*	-0.3317	0.0495
Yersinia	*Raoultella*	0.4311	0.0099
Yersinia	*Vagococcus*	-0.349	0.0198
Yokenella	*Bacillus*	-0.4931	0.0099

Yokenella	*Cedecea*	0.6762	0.0099
Yokenella	*Citrobacter*	0.3335	0.0495
Yokenella	*Enterobacter*	0.5015	0.0099
Yokenella	*Escherichia*	0.3462	0.0396
Yokenella	*Franconibacter*	0.327	0.0198
Yokenella	*Granulicatella*	-0.3469	0.0198
Yokenella	*Klebsiella*	0.3911	0.0198
Yokenella	*Kosakonia*	0.3191	0.0495
Yokenella	*Kurthia*	-0.3475	0.0198
Yokenella	*Leclercia*	0.3624	0.0396
Yokenella	*Pasteurella*	-0.373	0.0396
Yokenella	*Pectobacterium*	0.4971	0.0099
Yokenella	*Pluralibacter*	0.3162	0.0495
Yokenella	*Pseudocitrobacter*	0.372	0.0297
Yokenella	*Raoultella*	0.355	0.0396
Yokenella	*Salmonella*	0.6827	0.0099
Yokenella	*Staphylococcus*	-0.4568	0.0198
Yokenella	*Streptococcus*	-0.5505	0.0099
Yokenella	*Trichococcus*	-0.4188	0.0198
Yokenella	*Weissella*	-0.432	0.0297