Chapter 1

Introduction

1.1 Background

Escherichia coli is an opportunistic pathogen responsible for a variety of infections, including urinary tract infections, bloodstream infections, and gastrointestinal diseases. In recent years, the emergence of multidrug-resistant (MDR) strains has become a serious clinical challenge, as it limits treatment options (Kirtikliene et al., 2022). Carbapenems are commonly prescribed to treat infections caused by MDR bacteria. However, certain strains of *E. coli* have evolved mechanisms to neutralize these antibiotics, resulting in carbapenem-resistant Enterobacterales (CRE) (Smith and Kendall, 2020). This problem is further exacerbated by the slow pace of new antibiotic development and by bacterial genomic adaptation through horizontal gene transfer or spontaneous mutations, processes that are accelerated by the overuse of antibiotics. Given this growing threat, it has become urgent to explore alternative strategies for controlling bacterial infections.

Bacteriophages are viruses that specifically infect bacterial cells and are commonly found in environments such as wastewater. These phages are capable of attaching to specific surface receptors on their hosts. They follow two primary life cycles, which contribute to their therapeutic potential. Virulent, or lytic, phages immediately lyse their bacterial hosts, making them particularly suitable for phage therapy. In contrast, temperate, or lysogenic, phages integrate into the host genome as prophages and remain dormant until environmental cues trigger the lytic cycle (Elahi et al., 2021). Beyond their life cycle differences, phages also demonstrate remarkable specificity toward bacterial hosts, a trait that reduces collateral damage to beneficial microbiota. This specificity, along with their ability to co-evolve with bacteria, positions them as promising alternatives in the fight against multidrug-resistant infections (Olawade et al., 2024). However, little research has been conducted on phage isolation from various environmental samples, particularly wastewater in Bangkok, Thailand, as

well as the testing of these phages against pathogenic and drug-resistant *E. coli* strains. Thus, this study aimed to isolate and characterize bacteriophages targeting multidrug-resistant *E. coli*, providing a foundation for potential therapeutic applications.

1.2 Objective

This research aims to isolate and characterize bacteriophages originating from tropical wastewater environments in Thailand for activity against carbapenem-resistant *Escherichia coli*, in hopes of contributing to the development of phage-based therapies against multidrug-resistant bacteria.

1.3 Hypothesis

It was hypothesized that tropical wastewater environments in Thailand harbor diverse bacteriophages capable of infecting carbapenem-resistant *Escherichia coli*. Due to the high bacterial diversity present in such environments, the isolated phages were expected to exhibit relatively broad host ranges and remain stable under moderate pH, temperature, and chloroform conditions.