

Antibacterial Activity of the Epidermal Mucus of *Barbodes everetti*

JIAZHEN LIM, YANG LEE, BADIOZAMAN SULAIMAN, LESLEY MAURICE BILUNG & YEE LING CHONG*

Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia

*Corresponding author: ylchong@unimas.my; yeelingchong@gmail.com

ABSTRACT

The epidermal mucus of fish contains antimicrobial agents that act as biological defence against disease. This study aims to identify antibacterial activity and protein concentration of epidermal mucus of *Barbodes everetti*, a Bornean endemic freshwater fish. The epidermal mucus was extracted with 3% acetic acid, 0.85% sodium chloride and crude solvents. The mucus activity against eight strains of human pathogenic bacteria, including *Bacillus cereus* ATCC 33019, *Escherichia coli* O157:H7, *Listeria monocytogenes* ATCC 7644, *Pseudomonas aeruginosa* ATCC 27853, *Salmonella braenderup* ATCC BAA 664, *Salmonella typhimurium*, *Staphylococcus aureus* ATCC 25933, and *Vibrio cholerae*, were tested. The acetic acid mucus extract of *B. everetti* was able to inhibit five strains of bacteria and show no activity toward *E. coli* O157:H7, *B. cereus* ATCC 33019 and *L. monocytogenes* ATCC 7644. Moreover, the highest protein concentration was quantified in crude extract, followed by aqueous and acetic acid extracts. This study provides a preliminary knowledge on the activity of epidermal mucus of *B. everetti* towards five out of the eight human pathogens tested, therefore it may contain potential sources of novel antibacterial components which could be further extracted for the production of natural antibiotics towards human-related pathogenic bacteria.

Keywords: Antibacterial, antimicrobial properties, *Barbodes everetti*, epidermal mucus, pathogenic bacteria

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INTRODUCTION

Fish is the largest group of vertebrates on earth with approximately 33,900 species from 5,122 genera occupying and utilizing all the aquatic ecosystems (Kottelat, Whitten, Kartikasari & Wirjoatmodjo, 1993). The commonly known clown barb or Everett's barb (*Barbodes everetti*) is a cyprinid found in Sumatra and Borneo (Kottelat *et al.*, 1993) but it is claimed endemic to Borneo due to the absence of definitive record and evidence of existence in Sumatra. *B. everetti* can be found in clear and flowing or swiftly-moving forest streams with preference on quieter streams with depth no more than 15 cm (Kottelat *et al.*, 1993).

The epidermal mucus of fish is a mucosal layer on the fish skin, which acts as the first line defence against any foreign environmental agents such as bacteria, fungus, parasites, chemicals, drugs or animal actions, including predations, competitions and abrasion injuries (Esteban, 2012; Zaccane, Meseguer, García-Ayala & Kapoor, 2009). Foreign materials which approach and try to invade the fish will be entrapped in the mucosal layer and removed by the surrounding water current (Esteban, 2012). This layer of mucus is secreted by the epidermal and epithelial cells of fish to serve not only as protection but as lubricant that aid in locomotion and osmoregulation, as well as intra-specific chemical communication (Bernstein, Schluter & Marcholonis, 1997; Kuppulakshmi, Prakash, Gunasekaran, Manimegalai & Sarojini, 2008).

The antimicrobial properties of the epidermal mucus of fish may be related to their innate immune components such as the enzymes (e.g. lysozyme, acid and alkaline phosphate, cathepsins, etc.), proteases (i.e. serine, cysteine, aspartic and metallo-proteases), antibacterial peptides (e.g. alpha-helical amphipathic peptides, pardaxin, pleurocidins, etc.), lectins (e.g. congerin, AJL-1, etc.), proteins (e.g. lactoferrin, histone, ribosomal protein, etc.), or immunoglobins, and produce an undefined natural immunity in fish (Dhanaraj *et al.*, 2009; Esteban, 2012; Fast, Sims, Burka, Mustafa & Ross, 2002; Nigam, Kumari, Mittal & Mittal, 2012; Palaksha, Shin, Kim & Jung, 2008; Subramanian, MacKinnon & Ross, 2007). The epidermal mucus of fish contains certain antimicrobial agents that protect the fish against the colonization of pathogenic microorganisms (Subramanian, Ross & MacKinnon, 2008).

The study of Momoh, Mora, Ogbonna and Agboke (2014) revealed that the antimicrobial agents from the epidermal mucus of catfish can be used to substitute the present antibiotic in managing the clinical infectious diseases due to its higher permeability than commercial drug sample. However, there is limited published data of